TWIN DISC
INCORPORATED

Service Manual

Marine Transmission

Components:

MG5600
MG5600DR

Document Number: 1020007

NOTICE

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Document Number
1020007

May, 2001

Marine Transmission Service Manual

TWIN DISC, INCORPORATED
EXCLUSIVE LIMITED WARRANTY
COMMERCIAL MARINE TRANSMISSION

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of twenty-four (24) months from the date of shipment by Twin Disc, Incorporated to original customer, but not to exceed twelve (12) months of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated.** The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc, Incorporated 's application engineering.

B. **The exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective and the labor to perform that work and to remove and reinstall (or equivalent credit). In this context, labor is defined as the flat rate labor hours established by Twin Disc, Incorporated in the published Twin Disc Flat Rate Schedule, required to remove, disassemble, inspect, repair, reassemble, reinstall and test the Twin Disc, Incorporated product only. Authorized reasonable travel and living expenses will be considered for payment. Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, incidental or punitive damages.** The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in-warranty repair.

2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.

3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.

4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.

5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.

6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer 's and subsequent purchaser 's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no-charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

TWIN DISC, INCORPORATED
FLAT RATE HOUR ALLOWANCE

(Hourly Labor Rate Must be Acceptable to Twin Disc, Incorporated.)

COMMERCIAL MARINE TRANSMISSIONS - ALL RATIOS:

MODEL SERIES	R&R	UNIT REBUILD	CLUTCH REPAIR (BOTH PACKS)
MG 502, MG 5010, MG5011, MG5005A MG5015A	10.0	8.0	-
MG 506, MG5061, MG 5050, MG5055A	10.0	11.0	-
MG 507, MG 5081, MG5085, MG5090,	10.0	12.0	-
MG 5091	10.0	12.0	4.0
MG5112,MG5113	10.0	17.0	-
MG 509, MG 5111, MG5114	10.0	17.0	4.0
MG5114A, MG5114RV	10.0	17.0	-
MG 514C, MG514M, MG5141, MG514CHP	10.0	25.0	6.0
MG 516, MG 5161	10.0	28.0	8.0
MG 518-1	10.0	32.0	10.0
MG520-1, MG 5202, MG5203, MG5204	10.0	32.0	10.0
MG 530, MG530M, MG5301	12.0	32.0	16.0
MG 540	20.0	62.0	20.0
MG5600	20.0	62.0	20.0
MG6000	10.0	32.0	10.0
MGN80, MGN232, MGN233, MGN272, MGN273, MGN332, MGN334, MGN335, MGN432, MGN433, MGN472, MGN493	10.0	32.0	10.0
MGN650, MGN800,MGN1000,MGN1400, MGN1600	20.0	62.0	40.0
PUMP - ALL MODELS	1.0	-	
VALVE - ALL MODELS:	1.0	.5	

Table of Contents

Introduction 13
- General Information 13
- Safety and General Precautions 13
- Preventative Maintenance 15
- Towing 15
- Ordering Parts and Obtaining Services 16
- Source of Service Information 17
- Warranty 18

Description and Specifications 19
- General 19
- Power Ratings 21
- Power Flow 22
- Construction Features 23
- Lubrication Features 25
- Specifications 28
- Optional Equipment 30
- Torque Values for Fasteners 42
- Wear Limits 45

Operation 47
- General 47
- Hydraulic System with Manual Control Valve 48
- Manual Control Valve Assembly 50
- Hydraulic System with Electric Control Valve 56
- Live PTO (Optional) 65
- Trailing Pump (Optional) 65
- Power Flow 66

Preventative Maintenance 73
In-boat Maintenance and Repair 73
General Maintenance 74

Troubleshooting 79
Troubleshooting Chart 79

Disassembly 83
Prepare Transmission for Disassembly 84
Remove Transmission External Components and Sub-Assemblies 85
Disassemble Components and Sub-Assemblies 95
Disassembly of Upper Valve Body Half (electric section) 106

Cleaning and Inspection 109
Cleaning 109
Inspection 111

Assembly 115

Prior to Assembly 116
Preliminary Assembly 117
Output Shaft and Gear Assembly 120
Rear Output Shaft Bearing 126
Output Shaft Tapered Roller Bearing Adjustment 128
Assembly and Installation of the Primary and Secondary Shafts 131
Installation of the Bearing Carrier and Manifold 141
Installation of Manifold Exterior Components 149
Installation of Output Flange 150
Assembly of Mechanical Control Valve 154
Assembly of Electrical Control Valve (upperbody half) 155
Assembly of Electrical Control Valve (lower body half) 156
Selector Valve Installation 160
Input Reduction Components for Model MG-5600DR 161
Installation of Remaining Transmission External Components (all models unless noted) 163

Installation 167

Prior to Installation 167
Alignment (also reference SAE J-1033 and J-617) 168
Installation 173

Special Tools 199

Recommended Pump Set and Fluids 201
T-19987 Gear Lifting Fixture 203
T-19987 (detail 1, 2 and 3) Gear Lifting Fixture 204
T-19987 (detail 4) Gear Assembly Fixture 205
T-19987 (detail 5 and 6) Gear Assembly Fixture 206
T-18050-726 Clutch Pickup Fixture - Primary 207
T-18050-727 Clutch Pickup Fixture - Secondary 208
T-18050-682 Bearing Driver - Caged Roller 209
T-18050-685 Bearing Pick-Up and Driver 210
T-18050-686 Bearing Driver for Cup 211
T-18050-684 Bearing Driver for Outer Race 212
T-18050-687 Bearing Driver for Inner Race 213
T-18050-693 Driver - Seal 214
T-18050-681 Bearing Cone Driver 215
T-18050-689 Bearing Driver 216
T-18050-691 Bearing Driver 217
T-18050-690 Bearing Driver 218
T-18050-694 Spring Hold-Down Retainer 219
T-21413 (1 of 2) Output Flange Fixture 220
T-21413 (2 of 2) Output Flange Fixture 221
T-18050-692 Seal Driver 222
T-18050-683 Bearing Driver for Cone 223
T-05600 Lifting Tool for Clutch Removal in Boat 224
T-18050-688 (1 of 2) 225
T-18050-688 (2 of 2) 226
T-20023-1 (1 of 6) 227
T-20023-1 (2 of 6) 228
T-20023-1 (3 of 6) 229
T-20023-1 (4 of 6) 230
T-20023-1 (5 of 6) 231
T-20023-1 (6 of 6) 232

Engineering Drawings 233

1016473 Electric Trailing Pump 235
1015239-1 MG5600 236
1015239-2 MG5600 237
1015239-3 MG5600 238
1015239-4 MG5600 239
1015239-5 MG5600 240
1015239-6 MG5600 241
1015239-7 MG5600 242
1016001-1 MG5600 243
1016001-2 MG5600 244
1016001-3 MG5600 245
1016001-4 MG5600 246
1016001-5 MG5600 247
1016001-6 MG5600 248
1016001-7 MG5600 249
1018100-1 MG5600DR 250
1018100-2 MG5600DR 251
1018100-3 MG5600DR 252
1018100-4 MG5600DR 253
A7119S Hydraulic Schematic (Mechanical Valve) 254
A7119X Hydraulic Schematic (Electric Valve) 255
S570AH MG5600 Assembly Instructions 257
S570AK MG5600DR Assembly Instructions 265
B3504AH Mass Elastic System (MG5600) 275
B3504AT Mass Elastic System (MG5600DR) 276

Introduction

General Information

This publication provides operating information for Twin Disc model MG-5600 and MG-5600DR marine transmissions. Specific engineering details and performance characteristics can be obtained from the Product Service Department of Twin Disc, Incorporated, Racine, Wisconsin, USA..

Operation and maintenance personnel responsible for this equipment should be familiar with this publication and have it at their disposal. A thorough understanding and application of the material in this manual will result in consistent performance from the unit and help reduce downtime.

Safety and General Precautions

General

All personnel servicing this equipment should employ safe operating practices. Twin Disc, Inc. will not be responsible for personal injury resulting from careless use of hand tools, lifting equipment, power tools, or unaccepted maintenance/working practices.

Important Safety Notice

Proper installation, maintenance, and operation procedures must be followed due to the possible danger to person(s) or property from accidents that may result from the use of machinery. Twin Disc, Inc. will not be responsible for personal injury resulting from careless maintenance/working practices.

Inspect as necessary to assure safe operations under prevailing conditions. Proper guards and other safety devices that may be specified in safety codes should be provided. These devices are neither provided by, nor are they the responsibility of Twin Disc, Inc.

⚠ WARNING

Selecting NEUTRAL disengages transmission clutches but does not prevent propeller shaft rotation. If you require positive neutral (propeller shaft locked), a shaft brake or other shaft-locking device must be used.

⚠ WARNING

To prevent accidental starting of the engine when performing routine transmission maintenance, disconnect the battery cables from the battery and remove ignition key from the switch.

⚠ WARNING

Most Twin Disc products have provisions for attaching lifting bolts. The holes provided are always of adequate size and number to safely lift the Twin Disc product. These lifting points must not be used to lift the complete power unit. Lifting excessive loads at these points could cause failure at the lift point (or points) and result in damage or personal injury.

⚠ CAUTION

Select lifting eyebolts to obtain maximum thread engagement with bolt shoulder tight against housing. Bolts should be near but should not contact bottom of bolt hole.

Preventative Maintenance

Frequent reference to the information provided in the Marine Transmission Operator's Manual, 1016313, regarding daily operation and limitations of this equipment will assist in obtaining trouble-free operation. Schedules are provided for recommended maintenance of the equipment.

Towing

⚠ WARNING

Under the conditions described below, the prop shaft must be locked in place to prevent backdriving. Failure to do this can damage the marine transmission due to the lack of component lubrication.

Backdriving (also called windmilling) occurs when an engine is shut down and the propeller shaft is being driven by the flow of water across the propeller, which, in turn, rotates the components in the marine transmission. During backdriving conditions, the transmission does not receive proper lubrication.

Conditions where backdriving may occur:

- ❑ Vessel is being towed.
- ❑ One or more engines on a multiple-transmission vessel are shut down while under way.
- ❑ Sailboat under sail with auxiliary engine shut down.
- ❑ Vessel tied up or docked in a heavy current.

The following solutions are applicable for all MG-5600 Series transmissions if any of the above conditions are present:

- ❑ Lock the propeller shaft to prevent rotation.
- ❑ Add an electric-driven auxiliary oil pump into the lubrication circuit.

Refer to the hydraulic system prints for more details on auxiliary pump specifications for the applicable transmission, or contact your Twin Disc Authorized Distributor.

Ordering Parts and Obtaining Services

⚠ WARNING

All replacement parts or products (including hoses and fittings) must be of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Use of any other parts or products will void the warranty and may result in malfunction or accident, causing injury to personnel and/or serious damage to the equipment.

Ordering Service Parts

Renewal parts, service parts kits, optional equipment and product service assistance may be obtained from any authorized Twin Disc distributor or service dealer. Contact Twin Disc for the distributor or service dealer near you.

Note: Do not order parts from the part numbers on the cross-sectional drawings. These numbers may be referenced for part identification; however, they should be verified on the bill of material (BOM) before an order is placed. BOM numbers are stamped on the unit nameplate.

Twin Disc, having stipulated the bill of material number on the unit's nameplate, absolves itself of any responsibility resulting from any external, internal, or installation changes made in the field without the express written approval of Twin Disc. All returned parts, new or old, emanating from any of the above stated changes will not be accepted for credit. Furthermore, any equipment that has been subjected to such changes will not be covered by a Twin Disc warranty.

Source of Service Information

For the latest service information on Twin Disc products, contact any Twin Disc distributor or service dealer. This can be done on the Twin Disc corporate web site found at [http://www.twindisc.com]. Provide your model number, serial number and bill of material number to obtain information on your unit. If necessary, contact the Product Service Department, Twin Disc, Incorporated, Racine, Wisconsin 53405-3698, USA by e-mail at service@twindisc.com.

Warranty

Equipment for which this manual was written has a limited warranty. For details of the warranty, refer to the warranty statement at the front of this manual. For details of the warranty, contact any Twin Disc Authorized Distributor, service dealer, or the Warranty Administration Department, Twin Disc, Inc., Racine, Wisconsin, U.S.A.

Description and Specifications

General

There are four distinct assemblies in the MG-5600 marine transmission family, and all are included in this manual. They are identified by different drawings.

Assembly drawing 1015239 identifies an engine mounted unit that attaches directly with a flywheel housing. This unit has a mechanical control valve standard, with an electric control valve option.

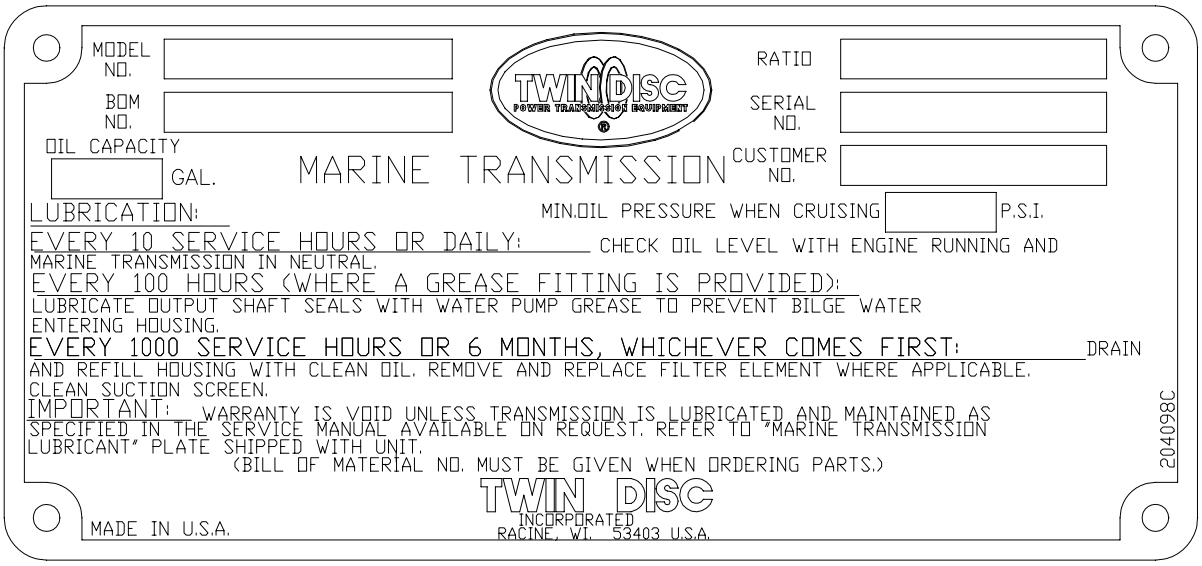
Assembly drawing 1016001 is identical, with the exception that it is a freestanding version.

Assembly drawing 1017614 is a freestanding unit with a higher power rating for right hand engine use only. This unit requires an electric control valve.

Assembly drawing 1018100 identifies a double reduction unit, designated as MG-5600DR. This unit (for service requirements) is essentially the same as assembly drawing 1017614 in a 5.04:1 reduction ratio, with an additional reduction section in front of the input section. This assembly requires an electric control valve.

Nameplate

The nameplate identifies the model, bill of material (BOM) and the serial number of the unit. These numbers are necessary to identify the correct parts for your transmission.


MODEL NO.
BOM NO.
OIL CAPACITY
GAL.
TWIN DISC
POWER TRANSMISSION EQUIPMENT
MARINE TRANSMISSION
RATIO
SERIAL NO.
CUSTOMER NO.
LUBRICATION:
MIN. OIL PRESSURE WHEN CRUISING
P.S.I.
EVERY 10 SERVICE HOURS OR DAILY: CHECK OIL LEVEL WITH ENGINE RUNNING AND MARINE TRANSMISSION IN NEUTRAL.
EVERY 100 HOURS (WHERE A GREASE FITTING IS PROVIDED):
LUBRICATE OUTPUT SHAFT SEALS WITH WATER PUMP GREASE TO PREVENT BILGE WATER ENTERING HOUSING.
EVERY 1000 SERVICE HOURS OR 6 MONTHS, WHICHEVER COMES FIRST: DRAIN AND REFILL HOUSING WITH CLEAN OIL. REMOVE AND REPLACE FILTER ELEMENT WHERE APPLICABLE. CLEAN SUCTION SCREEN.
IMPORTANT: WARRANTY IS VOID UNLESS TRANSMISSION IS LUBRICATED AND MAINTAINED AS SPECIFIED IN THE SERVICE MANUAL AVAILABLE ON REQUEST. REFER TO "MARINE TRANSMISSION LUBRICANT" PLATE SHIPPED WITH UNIT.
(BILL OF MATERIAL NO. MUST BE GIVEN WHEN ORDERING PARTS.)
204098C
MADE IN U.S.A.
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INCORPORATED
RACINE, WI. 53403 U.S.A.

Figure 1. Nameplate for MG-5600 Marine Transmissions

Power Ratings

The MG-5600 series transmissions can be operated through either the primary shaft or secondary shaft at its full rated horsepower when driven by a standard right hand rotation engine (counterclockwise flywheel rotation when viewing rear of engine). This series of marine transmissions can be driven by a left hand rotation engine, however horsepower ratings may be affected in some configurations. Contact an authorized Twin Disc distributor for more information.

Transmission clutches are hydraulically applied using main oil pressure. All bearings, clutches and gears are lubricated and cooled with low-pressure oil.

Always reference the Bill of Materials (BOM) or Specification number when ordering service parts.

Power Flow

Model MG-5600

Input power to the transmission is through a torsional coupling mounted on the engine flywheel. The coupling is splined to the forward end of the primary (forward clutch) shaft causing the primary shaft to rotate in engine direction. Power is transmitted to the secondary (reverse clutch) shaft through transfer gear teeth on the outer diameter (O.D.) of the primary clutch housing. These teeth are in mesh with gear teeth on the O.D. of the secondary clutch housing causing the secondary shaft to rotate in anti-engine direction. The primary and secondary pinions on their respective shafts are in constant mesh with the output gear, which is connected to the output shaft through a keyless tapered joint.

Application of the primary clutch locks the primary pinion to the primary shaft causing the pinion to turn in the shaft direction and causing the output shaft to rotate in anti-engine direction. Application of the secondary clutch locks the secondary pinion to the secondary shaft causing the pinion to turn in the shaft direction and causing the output shaft to rotate in engine direction.

Model MG-5600DR

Input power to the transmission is through a torsional coupling mounted on the engine flywheel. The coupling is splined to the input shaft and gear assembly, causing this to rotate in engine direction. Power is transmitted to the transfer gear that is spline connected to the primary clutch shaft, causing it to rotate opposite of engine rotation. Power is transmitted to the secondary (reverse clutch) shaft through transfer gear teeth on the outer diameter (O.D.) of the primary clutch housing. These teeth are in mesh with gear teeth on the O.D. of the secondary clutch housing causing the secondary shaft to rotate in engine direction. The primary and secondary pinions on their respective shafts are in constant mesh with the output gear, which is connected to the output shaft through a keyless tapered joint.

Application of the primary clutch locks the primary pinion to the primary shaft causing the pinion to turn in the shaft direction and causing the output shaft to rotate in engine direction. Application of the secondary clutch locks the secondary pinion to the secondary shaft causing the pinion to turn in the shaft direction and causing the output shaft to rotate in anti-engine direction.

Construction Features

Housings

The MG-5600 series transmission has a one-piece main housing. The 1015239 assembly has front housings in SAE No. 0 and SAE No. 00 sizes available. A top cover, bearing carrier, rear manifold (sealed with gaskets) complete the housing enclosure. Additionally, the MG-5600DR transmission has a two piece front reduction housing with bearing carriers.

Bearings

The primary and secondary clutch shafts and pinions are supported and located by a combination of straight and tapered roller bearings. Bearing clearances for each clutch shaft and pinion assembly are set by use of a single shim pack at the rear-tapered roller bearing on each shaft. Tapered and straight roller bearings also support the output shaft and have bearing clearance adjusted by use of shims at the rear bearing carrier. The MG-5600DR also has tapered roller bearings supporting the front reduction gear set with clearance adjusted at the front bearing retainers.

Oil Pump and Drive

The oil pump is spline driven by the secondary clutch shaft. The model MG-5600 has three different sized pumps, depending upon the engine full load governed speed. The model MG-5600DR has one pump size for all engine speed applications. Different pumps are available for operation on left hand rotation engines. See Table 1 for the pump part numbers for the various applications. Table 1 is for reference only. Verify correct part number on bill of material (BOM) prior to ordering new parts.

Table 1. Oil Pump Part Numbers

Engine Full Load Governed Speed	900 - 1299 rpm		1300 - 1699 rpm		1700 - 2100 rpm	
Engine Rotation	RH	LH	RH	LH	RH	LH
MG-5600 Assembly 1015239	1016698	1016701	1016699	1016702	1016700	1016703
MG-5600 Assembly 1016001	1016698	1016701	1016699	1016702	1016700	1016703
MG-5600 Assembly 1017614	1016698	NA	1016699	NA	1016700	NA
MG-5600DR Assembly 1018100	1016702	1016699	1016702	1016699	1016702	1016699

Table 2. Oil Pump Flow

Pump Part Number	Pump Speed (rpm)	Pump Flow	
		l/min	gal/min
1016698	1200	189.3	50
1016699	1500	189.3	50
1016700	1900	192.3	50.8
1016701	1200	189.3	50
1016702	1500	189.3	50
1016703	1900	192.3	50.8

Table 3. Pump vs. Engine RPM

Ratio	Engine rpm for 1500 rpm Pump Speed
7.01:1	2088
6.56:1	1953
6.02:1	1795

Lubrication Features

The MG-5600 series transmission has a lubrication tube located inside the main housing. The tube extends from the front to the rear of the inside of the housing. The lubrication tube has drilled holes in the tube that spray oil on the transfer gears and the primary and secondary pinions. Bearings and clutches on the primary and secondary shafts are lubricated through drilled passages in the shafts. Output shaft bearings are gravity and splash lubricated. The input reduction gears and bearings are lubricated by splash lubrication resulting from the input gear dipping in oil trapped in the housing by a standpipe, and supplied by a passage in the front of the primary clutch shaft.

Suction Screen

The marine transmission has a serviceable suction strainer located in the oil pump suction tube at the housing end. The strainer can be replaced if necessary.

Filter Assembly

A canister-style filter is located between the heat exchanger inlet and the selector valve in the hydraulic circuit. The replacement element is Twin Disc part number M2725. This should be replaced at 1000 hour or six month intervals, whichever comes first.

Gears

All gears are helical, carburized, hardened and ground for smooth quiet operation. All gears are in constant mesh. The primary and secondary transfer gears and the output gear are mounted on keyless tapers. The input reduction gears of the MG-5600DR are one piece, and mounted on tapered roller bearings

Flexible Torsional Input Coupling

The purpose of the torsional coupling is to transmit power from the engine to the marine transmission through a rubber or silicone element that will:

- ❑ Dampen torsional vibrations
- ❑ Change the natural frequencies of a system to move critical frequencies out of the operating speed range
- ❑ Accommodate a certain amount of misalignment
- ❑ Absorb shock and reduce noise
- ❑ Minimize gear “rattle”

Several couplings are available from Twin Disc, and are selected based on the customer supplied engine information. Final coupling selection must be confirmed by the packager based on the torque/rpm ratings and the results of the system torsional vibration analysis (TVA), and on engine rotation. Care must be taken when servicing that replacement couplings are matched to this criteria.

Heat Exchanger

The heat exchanger is designed to maintain the oil in the hydraulic system of the marine transmission at the proper temperature by passing raw or fresh water through the heat exchanger. The cooler is selected for a water temperature of 130° F max. The heat exchanger is located on the top of the marine transmission.

Specifications

Maximum operating speed: 2100 rpm

Maximum oil sump temperature: 200° F

Oil type and viscosity: See data plate below

Oil capacity: 110 liters (29 gal)

Approximate Dry weight:

MG-5600: 6770 lbs.

MG-5600DR: 7100 lbs.

Oil pressure: See Tables 4 and 5. Oil temperature to be in normal operating range.

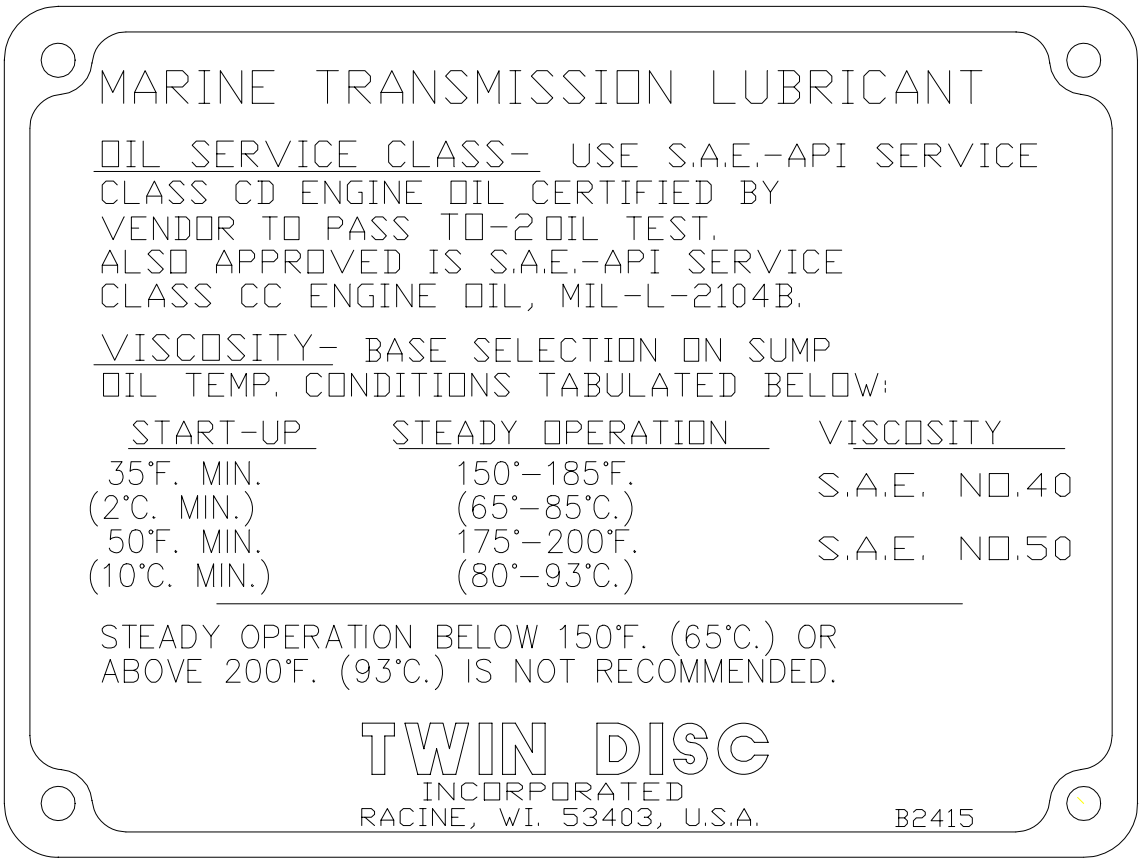

MARINE TRANSMISSION LUBRICANT
OIL SERVICE CLASS- USE S.A.E.-API SERVICE CLASS CD ENGINE OIL CERTIFIED BY VENDOR TO PASS TO-2 OIL TEST. ALSO APPROVED IS S.A.E.-API SERVICE CLASS CC ENGINE OIL, MIL-L-2104B.
VISCOSITY- BASE SELECTION ON SUMP OIL TEMP. CONDITIONS TABULATED BELOW:
START-UP
STEADY OPERATION
VISCOSITY
35°F. MIN. (2°C. MIN.)
150°-185°F. (65°-85°C.)
S.A.E. NO.40
50°F. MIN. (10°C. MIN.)
175°-200°F. (80°-93°C.)
S.A.E. NO.50
STEADY OPERATION BELOW 150°F. (65°C.) OR ABOVE 200°F. (93°C.) IS NOT RECOMMENDED.
TWIN DISC
INCORPORATED
RACINE, WI. 53403, U.S.A.
B2415

Figure 2. Oil Specification Plate

Table 4. Oil Pressure Specifications

Mechanical Valve - 250 psi Springs									
Input Speed	Shift Position	Main Pressure at Valve Inlet		Primary Clutch Min.		Secondary Clutch Min.		Lube	
		kPa	psi	kPa	psi	kPa	psi	kPa	psi
Idle	Neutral	125-130	18 - 51	0	0	0	0	20-140	3 - 20
Idle	Primary	1660-1790	240-260	1660	240	0	0	7- 69	1-10
Idle	Secondary	1660-1790	240-260	0	0	1660	240	7-69	1-10
Rated	Neutral	280-590	40 -85	0	0	0	0	280-450	40-65
Rated	Primary	1690-1830	245-265	1690	245	0	0	100-380	15-55
Rated	Secondary	1690-1830	245-265	0	0	1690	245	100-380	15-55

Table 5. Oil Pressure Specifications

Electric Valve - 290 psi Springs									
Input Speed	Shift Position	Main Pressure at Valve Inlet		Primary Clutch Min.		Secondary Clutch Min.		Lube	
		kPa	psi	kPa	psi	kPa	psi	kPa	psi
Idle	Neutral	255-310	37-45	0	0	0	0	20-140	3-20
Idle	Primary	1724-1931	250-280	1724	250	0	0	7-69	1-10
Idle	Secondary	1724-1931	250-280	0	0	1724	250	7-69	1-10
Rated	Neutral	280-689	40-100	0	0	0	0	280-450	40-65
Rated	Primary	1960-2137	285-310	1960	285	0	0	100-380	15-55
Rated	Secondary	1960-2137	285-310	0	0	1960	285	100-380	15-55

Optional Equipment

The following optional equipment for use with the model MG-5600 and MG-5600DR is available through the nearest authorized Twin Disc distributor.

Optional Trailing Pump

A 115 vac electric powered trailing pump system is available. It is identified as part number 1016473. A drawing is included in the Engineering Drawings.

Power Take-off

A live power take-off pump mount (size C 2 bolt or 4 bolt) is available. It is identified as BOM 40106.

Electric Control Valve

An electric control valve is available with either 12 vdc or 24 vdc actuating solenoids. These are identified as 1018084J (12 vdc) and 1018084H (24 vdc).

Coupling Flange for Shaft Brake

A coupling flange for disc type propeller shaft brake applications is available. It is 1018651.

Oil Bypass Thermostatic Valve Kit

A thermostatic oil bypass valve arrangement is available.

Metric to NPTF Adapter Kit

An adapter kit (K1232) is available to convert the oil drain plug opening and the pressure test ports from metric to NPTF threads.

Mounting Brackets

Steel fabricated mounting brackets for rigid mounting are available. They are 1016428AA and 1016428AB.

Torsional Input Coupling

Several models of torsional input couplings are available.

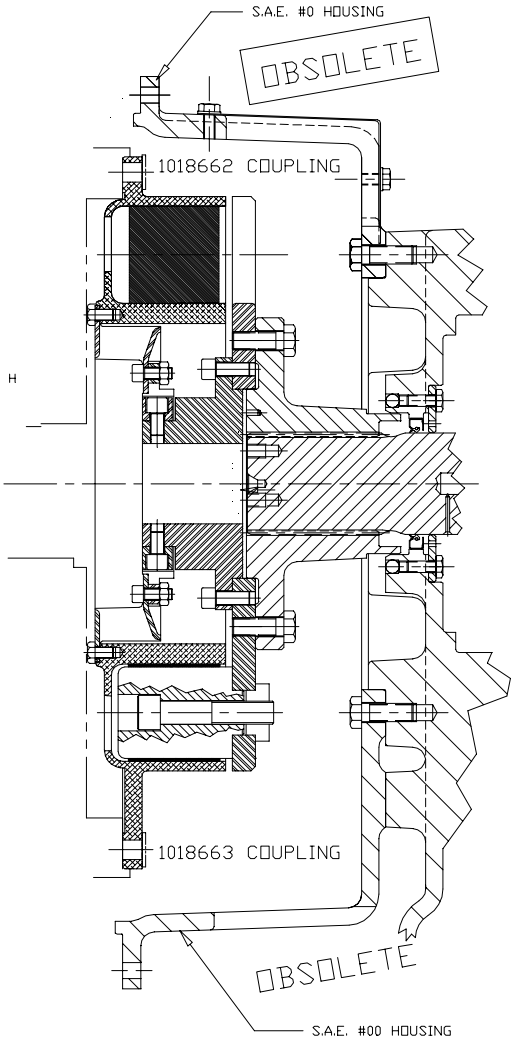


Figure 3. Close Coupled Centa CF-DS (Obsolete)

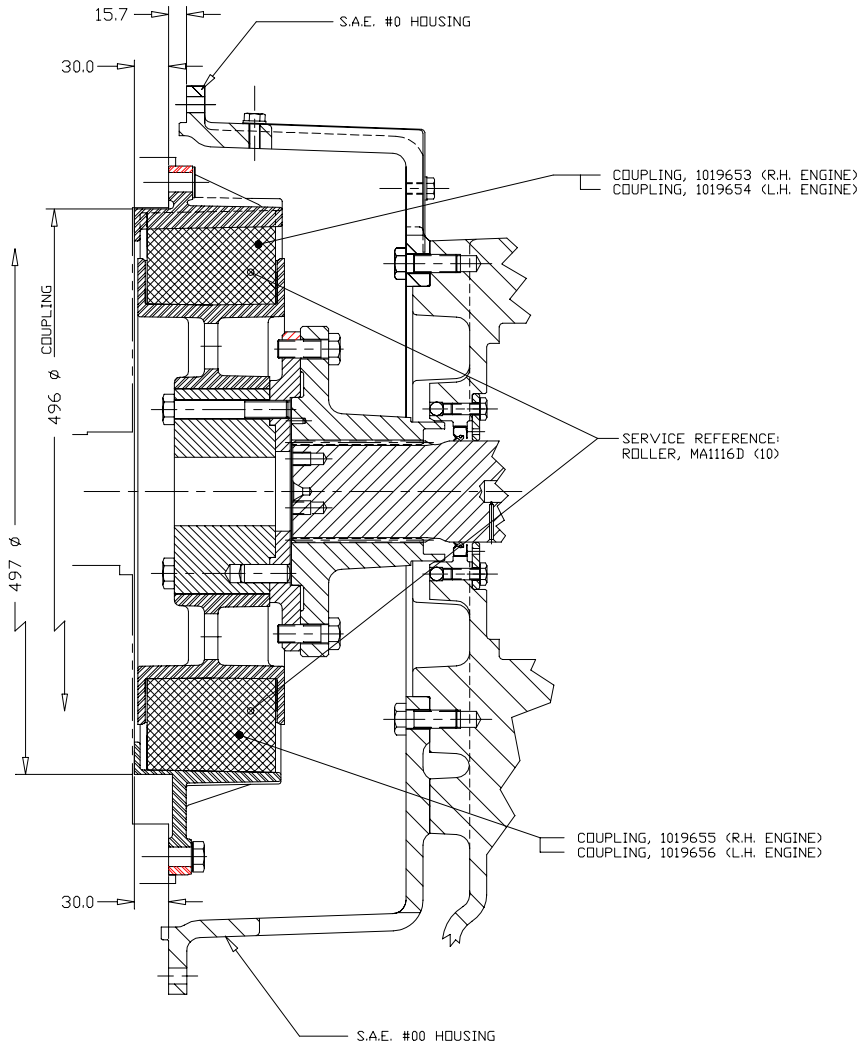


Figure 4. Close Coupled Centa CF-R-510

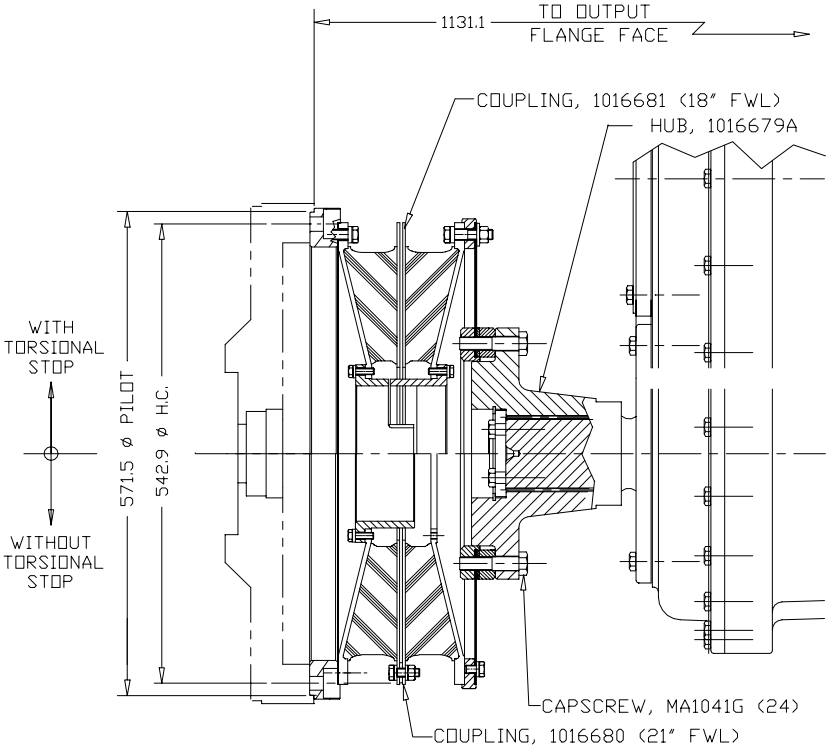


Figure 5. Remote Vulkan R 1721 No. 460 Flywheel

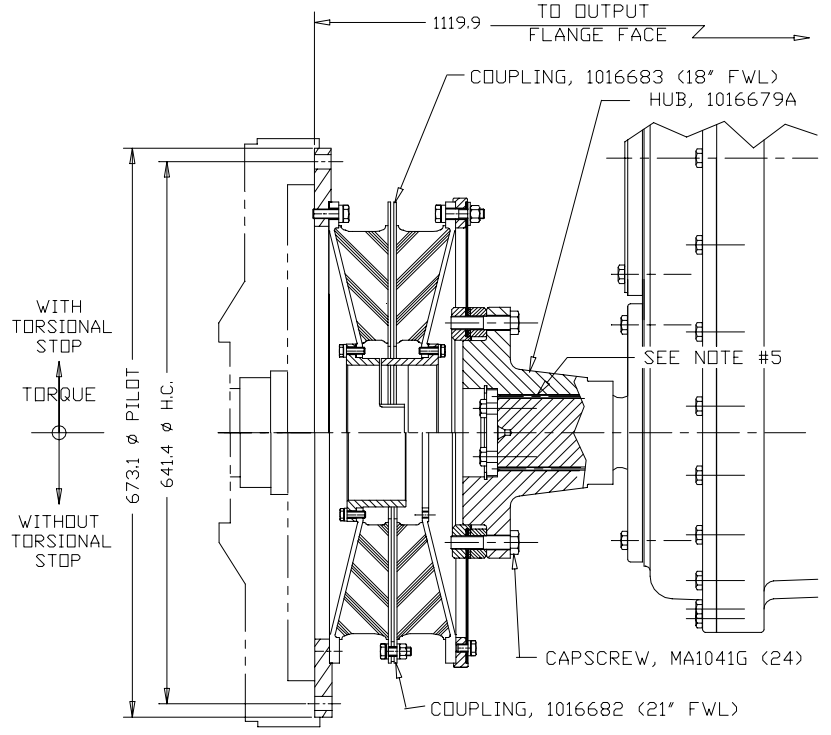


Figure 6. Remote Vulkan R 1721 No. 530 Flywheel

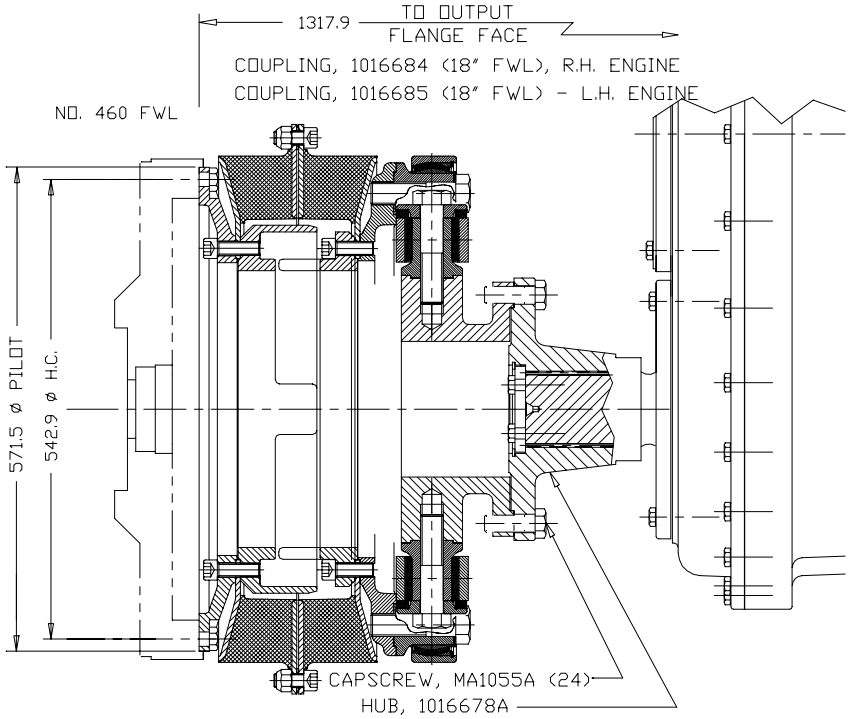


Figure 7. Remote Centa CX 72 No. 460 Flywheel

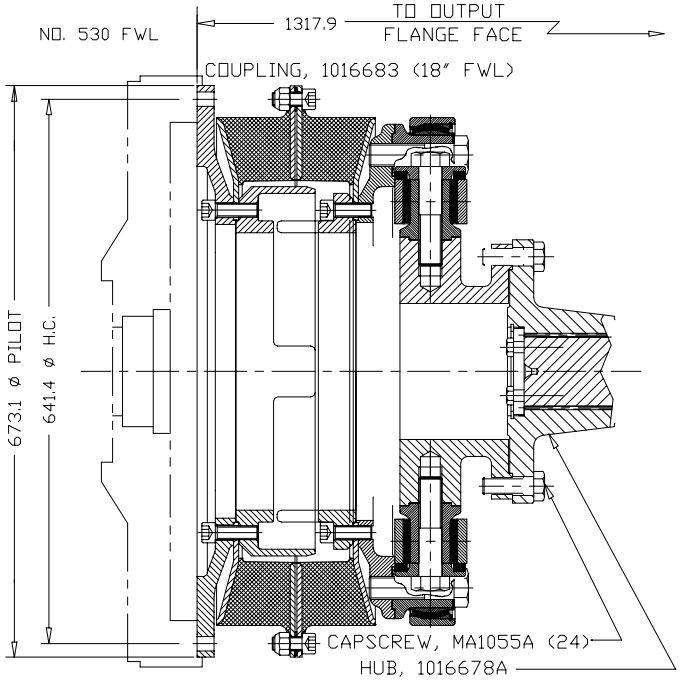


Figure 8. Remote Centa CX 72 No. 530 Flywheel

Table 6. Gear Advance

Transmission Primary Transfer Gear Advance		
Minimum	**Actual**	**Maximum**
3.33mm (.131 in)		4.29mm (.169 in)
Transmission Secondary Transfer Gear Advance		
Minimum	**Actual**	**Maximum**
3.33mm (.131 in)		4.29mm (.169 in)
Transmission Output Gear Advance		
Minimum	**Actual**	**Maximum**
11.86mm (.467 in)		13.54mm (.533 in)
Transmission Output Flange Advance		
Minimum	**Actual**	**Maximum**
10.16mm (.400 in)		12.35mm (.486 in)

Table 7. Bearing End Play

Reduction Gear Input Shaft Tapered Roller Bearing Endplay		
Minimum	**Actual**	**Maximum**
0.05 mm (.002 in)		0.15 mm (.006 in)
Reduction Gear Output Shaft Tapered Roller Bearing Endplay		
Minimum	**Actual**	**Maximum**
0.05 mm (.002 in)		0.15 mm (.006 in)
Transmission Primary Shaft Tapered Roller Bearing Endplay		
Minimum	**Actual**	**Maximum**
0.05 mm (.002 in)		0.15 mm (.006 in)
Transmission Secondary Shaft Tapered Roller Bearing Endplay		
Minimum	**Actual**	**Maximum**
0.05 mm (.002 in)		0.15 mm (.006 in)
Transmission Output Shaft Bearing Endplay		
Minimum	**Actual**	**Maximum**
0.05 mm (.002 in)		0.15 mm (.006 in)

Table 8. Limits for Marine Transmissions Equipped with Manual Control Valve with 1725 kPa (250 psi) Spring

(circle units in actual column)

rpm	Range	Main Pressure at Valve Inlet			Primary Clutch		Secondary Clutch		Lube			Temp
		Min kPa (psi)	Act kPa (psi)	Max kPa (psi)	Min kPa (psi)	Act kPa (psi)	Min kPa (psi)	Act kPa (psi)	Min kPa (psi)	Act kPa (psi)	Max kPa (psi)	deg. C deg. F
1100 1500 1900	Primary	1690 (245)		1830 (265)	1690 (245)		0 (0)		100 (15)		380 (55)	
	Secondary	1690 (245)		1830 (265)	0 (0)		1690 (245)		100 (15)		380 (55)	
	Neutral	280 (40)		590 (85)	0 (0)		0 (0)		280 (40)		450 (65)	
600	Primary	1660 (240)		1790 (260)	1660 (240)		0 (0)		7 (1)		69 (10)	
	Secondary	1660 (240)		1790 (260)	0 (0)		1660 (240)		7 (1)		69 (10)	
	Neutral	125 (18)		350 (51)	0 (0)		0 (0)		20 (3)		140 (20)	

*Input Speed Ranges (test speed):

- ❑ 900-1299 rpm (1100 rpm)
- ❑ 1300-1699 rpm (1500 rpm)
- ❑ 1700-2100 rpm (1900 rpm)

⚠ CAUTION

Do not exceed maximums.

Note: It is required that lube pressure with primary clutch engaged must equal lube pressure with secondary clutch engaged within 21 kPa (3 psi).

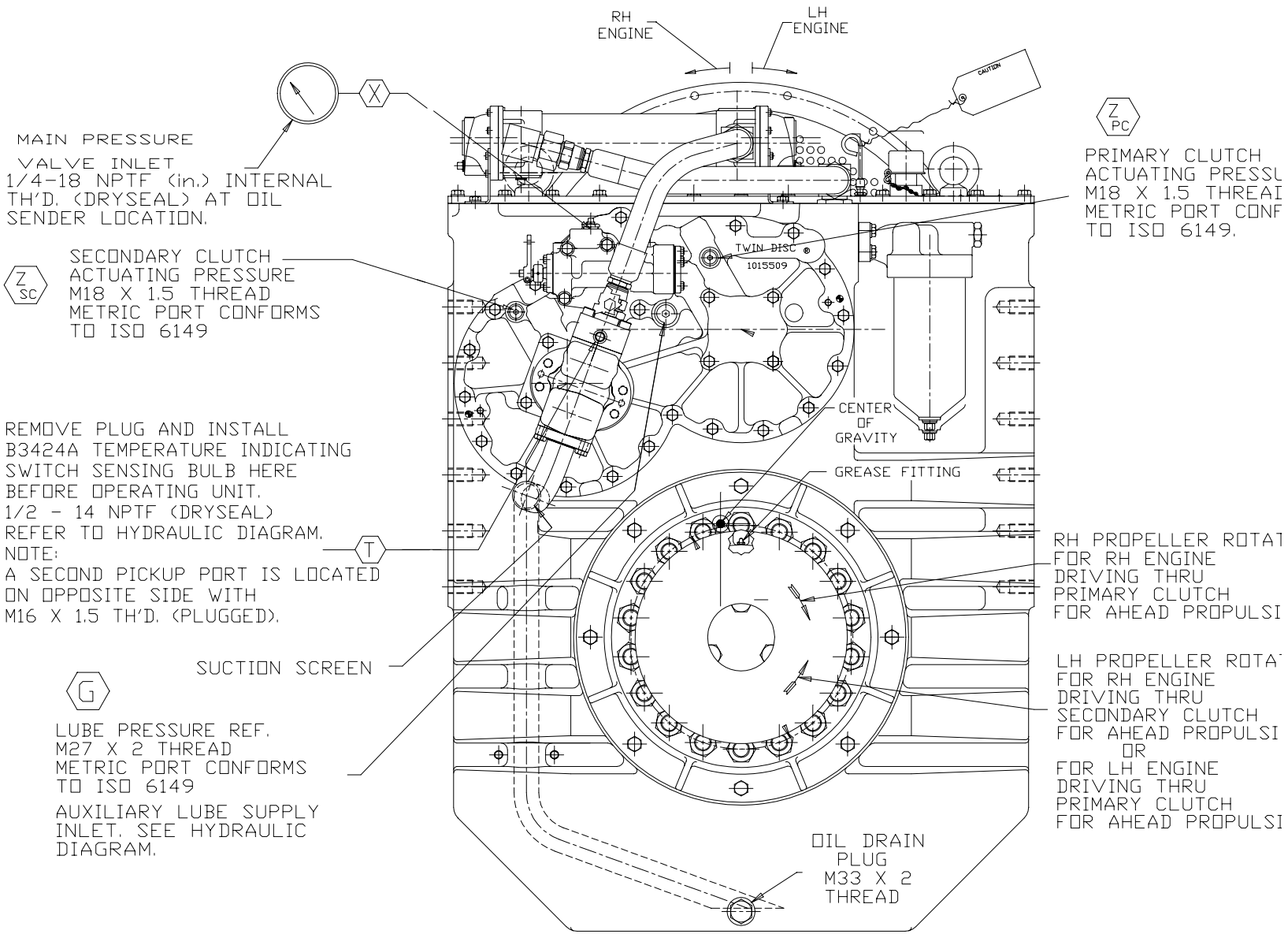

RH ENGINE
LH ENGINE
CAUTION
X
MAIN PRESSURE VALVE INLET 1/4-18 NPTF (in.) INTERNAL TH'D. (DRYSEAL) AT OIL SENDER LOCATION.
Z PC
PRIMARY CLUTCH ACTUATING PRESSU M18 X 1.5 THREAI METRIC PORT CONF TO ISO 6149.
TWIN DISC 1015509
Z SC
SECONDARY CLUTCH ACTUATING PRESSURE M18 X 1.5 THREAD METRIC PORT CONFORMS TO ISO 6149
CENTER OF GRAVITY
GREASE FITTING
REMOVE PLUG AND INSTALL B3424A TEMPERATURE INDICATING SWITCH SENSING BULB HERE BEFORE OPERATING UNIT. 1/2 - 14 NPTF (DRYSEAL) REFER TO HYDRAULIC DIAGRAM. NOTE: A SECOND PICKUP PORT IS LOCATED ON OPPOSITE SIDE WITH M16 X 1.5 TH'D. (PLUGGED).
T
RH PROPELLER ROTAT FOR RH ENGINE DRIVING THRU PRIMARY CLUTCH FOR AHEAD PROPULSI
SUCTION SCREEN
LH PROPELLER ROTA FOR RH ENGINE DRIVING THRU SECONDARY CLUTCH FOR AHEAD PROPULSI OR FOR LH ENGINE DRIVING THRU PRIMARY CLUTCH FOR AHEAD PROPULSI
G
LUBE PRESSURE REF. M27 X 2 THREAD METRIC PORT CONFORMS TO ISO 6149
AUXILIARY LUBE SUPPLY INLET. SEE HYDRAULIC DIAGRAM.
OIL DRAIN PLUG M33 X 2 THREAD

Figure 9. Installation Specifications (1)

Table 9. Limits for Marine Transmission Equipped with Electronic Control Valve with 2000 kPa (290 psi) Spring

(circle units in actual column)

Ratio or rpm	Range	Main Pressure at Valve Inlet			Primary Clutch		Secondary Clutch		Lube			Temp deg. C deg. F
		Min kPa (psi)	Act kPa (psi)	Max kPa (psi)	Min kPa (psi)	Act kPa (psi)	Min kPa (psi)	Act kPa (psi)	Min kPa (psi)	Act kPa (psi)	Max kPa (psi)	
Ratio 7.01:1 2100rpm 6.56:1 1950rpm 6.02:1 1800rpm	Primary	1960 (285)		2137 (310)	1960 (285)		0 (0)		100 (15)		380 (55)	
	Secondary	1960 (285)		2137 (310)	0 (0)		1960 (285)		100 (15)		380 (55)	
	Neutral	280 (40)		689 (100)	0 (0)		0 (0)		280 (40)		450 (65)	
rpm 780	Primary	1724 (250)		1931 (280)	1724 (250)		0 (0)		7 (1)		69 (10)	
	Secondary	1724 (250)		1931 (280)	0 (0)		1724 (250)		7 (1)		69 (10)	
	Neutral	255 (37)		310 (45)	0 (0)		0 (0)		20 (3)		140 (20)	

Note: It is required that lube pressure with primary clutch engaged must equal lube pressure with secondary clutch engaged within 21 kPa (3 psi).

⚠ CAUTION

All shifts must be done at or below 1200 rpm.

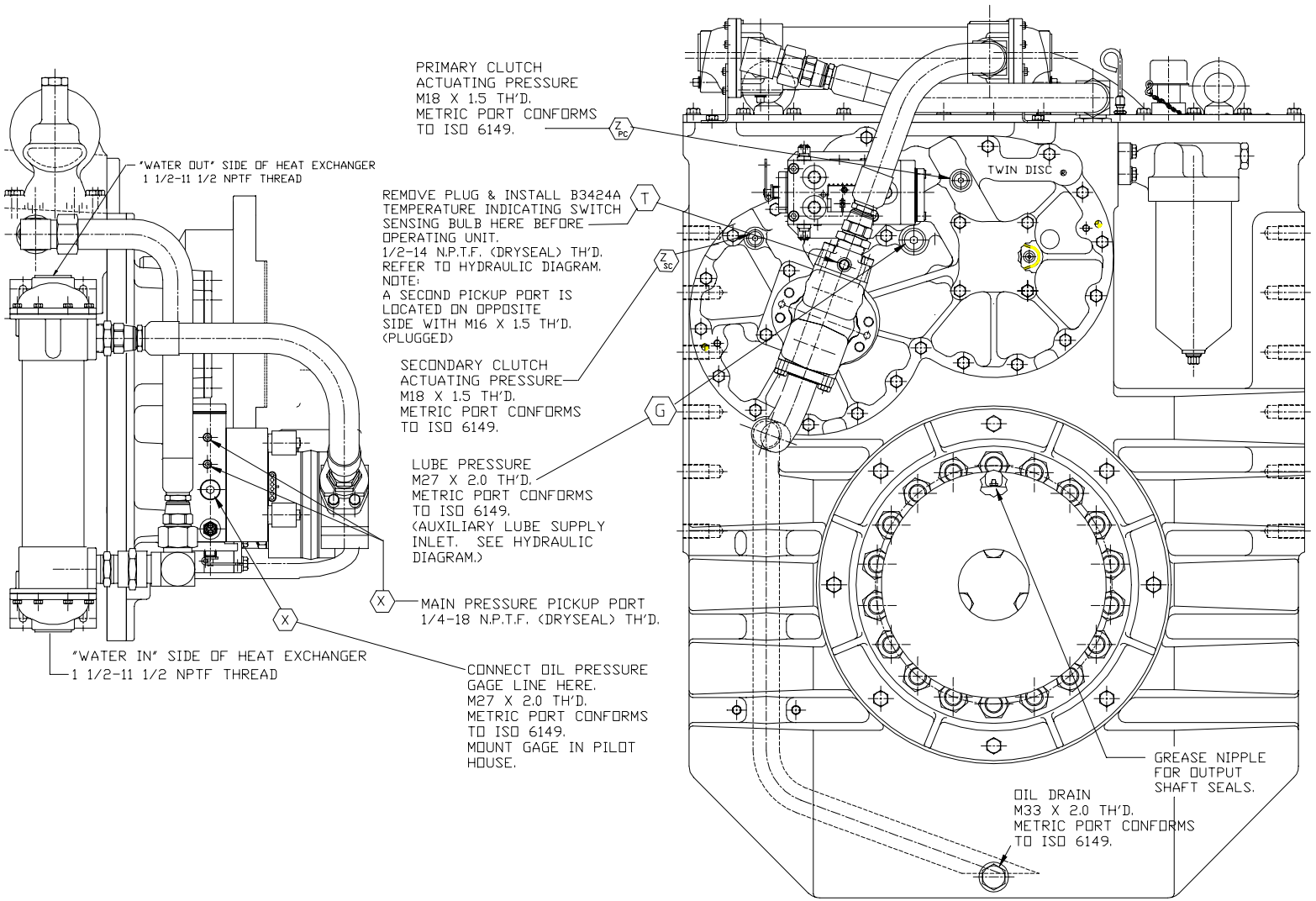


Figure 10. Installation Specifications (2)

Torque Values for Fasteners

Note: All threads and bearing face to be lubricated with light oil film prior to assembly.

Table 10. U.S. Standard Fine and Coarse Thread Capscrews, Bolts, and Nuts

Thread Diameter	SAE Grade 5		SAE Grade 8	
	lb-ft	Nm	lb-ft	Nm
1/4	6 - 8	8 - 11	10 - 12	14 - 16
5/16	13 - 17	18 - 23	20 - 24	27 - 32
3/8	25 - 29	34 - 39	35 - 41	48 - 55
7/16	37 - 43	51 - 58	55 - 65	75 - 88
1/2	60 - 70	81 - 95	83 - 97	113 - 131
9/16	82 - 98	111 - 132	120 - 140	163 - 190
5/8	120 - 140	163 - 190	165 - 195	224 - 264
3/4	205 - 245	278 - 332	295 - 345	400 - 467
7/8	330 - 390	448 - 528	470 - 550	638 - 745
1	495 - 595	671 - 806	715 - 845	970 - 1145
1 1/8	615 - 745	834 - 1010	1015 - 1185	1377 - 1606
1 1/4	850 - 1000	1163 - 1355	1375 - 1625	1865 - 2203

Table 11. Metric Coarse Thread Capscrews, Bolts, and Nuts

Thread Size	Property Class 8.8		Property Class 10.9		Property Class 12.9	
	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm
M6	6.5 - 7.5	9 - 10	9 - 10	12 - 14	10 - 12	14 - 16
M8	16 - 18	21 - 25	23 - 26	31 - 35	25 - 29	34 - 40
M10	32 - 36	43 - 49	44 - 51	60 - 68	51 - 59	70 - 80
M12	55 - 63	74 - 86	77 - 88	104 - 120	89 - 103	121 - 139
M16	132 - 151	179 - 205	189 - 217	256 - 294	219 - 253	298 - 342
M20	257 - 295	348 - 400	364 - 418	493 - 567	429 - 493	581 - 669
M24	445 - 511	603 - 693	626 - 720	848 - 976	737 - 848	1000 - 1150
M30	714 - 820	987 - 1113	1235 - 1421	1674 - 1926	1475 - 1697	2000 - 2301

Table 12. Tapered Pipe Plugs (with thread lubricant)

NPTF Size (in)	Nm (+ or - 5 %)	lb-ft (+ or - 5 %)	Nm (+ or - 5 %)	lf-ft (+ or - 5 %)
1/16-27	11.5	8.5	7.5	5.5
1/8-27	14	10.5	9	6.5
1/4-18	34	25	21.5	16
3/8-18	36.5	27	23	17
1/2-14	68	50	40.5	30
3/4-14	73	54	46	34
1 -11 1/2	108	80	68	50
1 1/4 - 11 1/2	115	85	75	55
1 1/2 - 11 1/2	115	85	75	55

Table 13. Straight Threaded Tube Fittings, Hose Fittings, and O-ring Plugs

Nominal Thread Diameter	Nm + or - 5 %	lb-ft + or - 5 %	Nominal Thread Diameter	Nm + or - 5 %	lb-ft + or - 5 %
5/16	5	3.5	M10X1.0	26	19
3/8	11.5	8.5	M12X1.5	37	27
7/16	16	12	M14X1.5	47	35
1/2	20	15	M16X1.5	58	43
9/16	24.5	18	M18X1.5	74	55
5/8	24.5	18	M22X1.5	105	77
11/16	34	25	M27X2.0 IN IRON	179	132
3/4	40.5	30	M27X2.0 IN ALUM	85	63
7/8	54	40	M33X2.0	326	240
1 1/16	75	55	M42X2.0	347	256
1 3/16	88	65	M48X2.0	441	325
1 1/4	88	65	-	-	-
1 5/16	108	80	-	-	-
1 3/8	108	80	-	-	-
1 5/8	135	100	-	-	-
1 7/8	162	120	-	-	-
2 1/2	312	230	-	-	-

Wear Limits

Clutch Plates

Steel separator plates cone:

Minimum: 0.012 in.

Maximum: 0.022 in.

Friction clutch plates cone:

Maximum: 0.010 in.

Friction clutch plates minimum thickness: 0.137 in.

Operation

General

The control valve obtains primary, neutral and secondary positions. When these positions are selected, the control valve directs high-pressure oil through internal passages to operate the clutches.

Hydraulic System with Manual Control Valve

The oil pump draws oil through the strainer from the oil sump and discharges it through the heat exchanger and filter to the combination control and pressure-regulating valve. The oil enters the pressure-regulating area of the valve where main pressure is regulated by cascading excess oil into the lubrication oil circuit. Lubrication oil is distributed through fixed controlled orifices to lubricate and cool the clutches and bearings. There is a lubrication oil relief valve to limit the maximum lubrication oil pressure. This pressure is regulated to approximately 690 kPa (100 psi) on the MG-5600, and approximately 827 kPa (120 psi on the MG-5600DR.

In Neutral, the inlet port of both clutches is connected to the atmosphere. Since the area behind the clutch pistons is open to sump, the clutches are disengaged. Oil is distributed through the lubrication system. The area between the pressure regulating piston and the rate-of-rise piston is connected to sump at all times to prevent any leakage oil from affecting the pressure regulation.

When the control valve is shifted to engage either clutch, the valve directs main pressure to engage the selected clutch pack. Oil is also directed to move the rate-of-rise piston, compressing the pressure regulator springs. This progressively increases the clutch engaging pressure causing the clutches to engage at a controlled rate.

The control valve allows only one clutch to be engaged at a time, and the oil from the disengaged clutch is vented to sump (atmospheric pressure). The clutch return springs move the disengaged clutch's piston to the disengaged position minimizing clutch plate drag.

General

The control valve assembly contains passages and ports to direct pressurized oil within the transmission's hydraulic system. The pressure-rate control piston within the control valve assembly provides a rapid, smooth, oil pressure increase in the hydraulic system during clutch engagement.

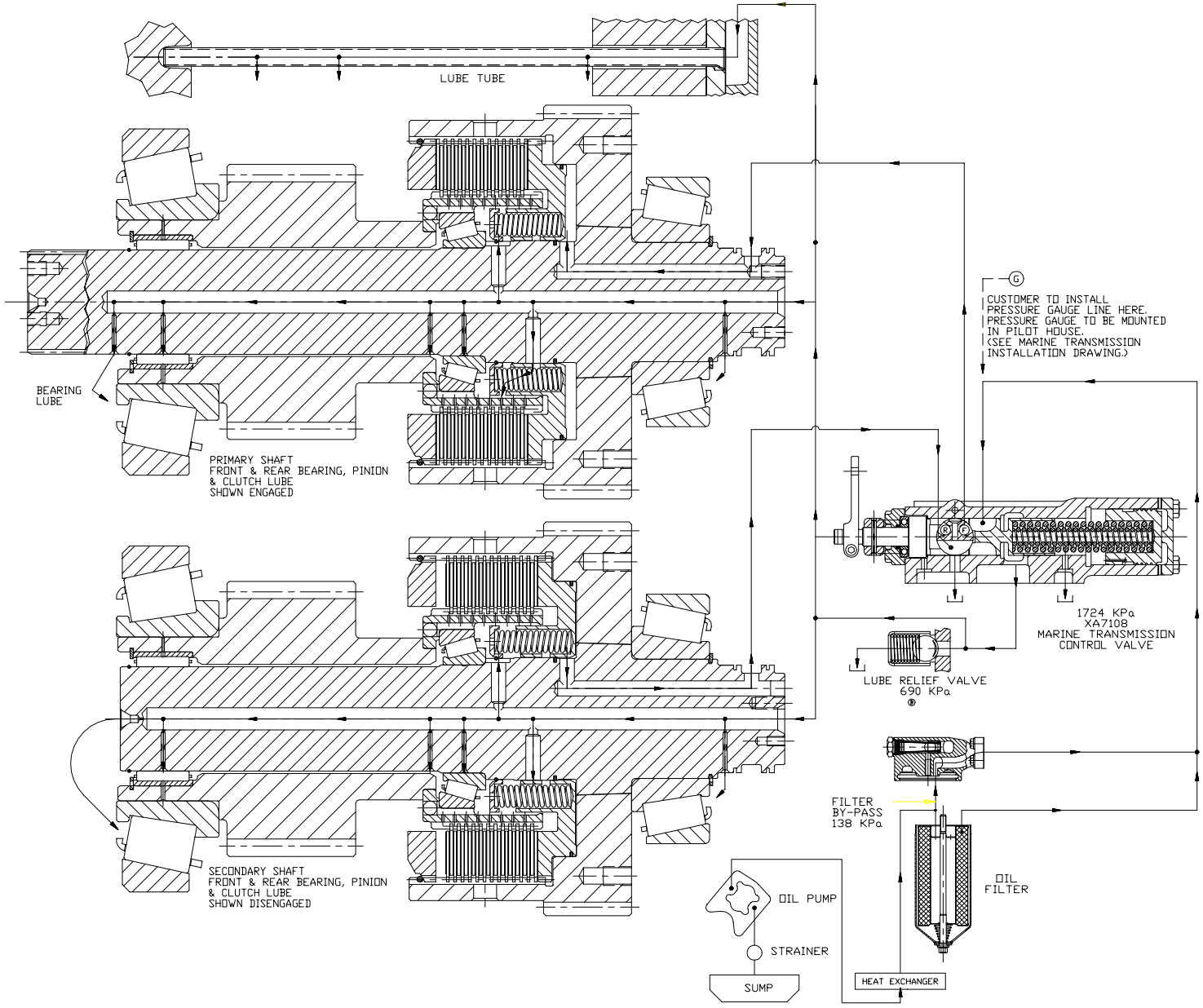

LUBE TUBE
BEARING LUBE
PRIMARY SHAFT FRONT & REAR BEARING, PINION & CLUTCH LUBE SHOWN ENGAGED
SECONDARY SHAFT FRONT & REAR BEARING, PINION & CLUTCH LUBE SHOWN DISENGAGED
G
CUSTOMER TO INSTALL PRESSURE GAUGE LINE HERE. PRESSURE GAUGE TO BE MOUNTED IN PILOT HOUSE. (SEE MARINE TRANSMISSION INSTALLATION DRAWING.)
1724 KPa XA7108 MARINE TRANSMISSION CONTROL VALVE
LUBE RELIEF VALVE 690 KPa
FILTER BY-PASS 138 KPa
OIL FILTER
OIL PUMP
STRAINER
SUMP
HEAT EXCHANGER

Figure 11. Hydraulic Schematic Manual Control Valve

Manual Control Valve Assembly

Manual Control Valve — Neutral

Refer to Figures 12 and 13. Oil enters the control valve body through passage A and fills chamber B. The oil causes the pressure regulating piston to partially compress the piston outer and inner springs against the pressure-rate control piston. This pressurizes the oil in chamber B. This pressure varies with engine speed.

The movement of the pressure regulation piston against the springs exposes port C in the valve body. Port C directs overage oil to the lubrication oil circuit. Passage D (which is the engaging outlet to the primary clutch) and Passage E (which is the engaging outlet to the secondary clutch) are interconnected by slot F in the control valve stem when in the neutral position. The slot is aligned with a drilled hole and cored cavity in the face of the valve body. The drilled hole and cored cavity are aligned and drilled holes that pass through the main housing to sump. Therefore, passages D and E are at atmospheric pressure at this time. Also, passage J is at atmospheric pressure because port H interconnects with slot F. This area between pistons and around springs is vented to the sump of the transmission. This area is at atmospheric pressure at all times permitting the return to sump of any leakage oil past the pistons.

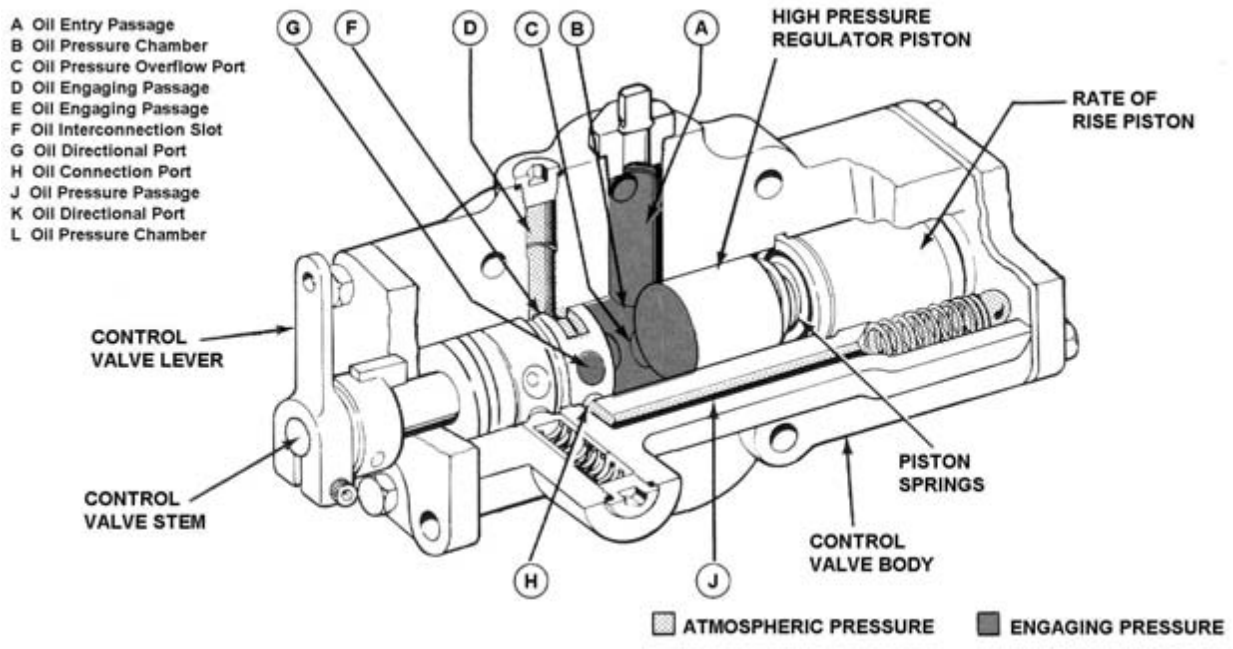


Figure 12. Manual Control Valve — Neutral — Sectional View

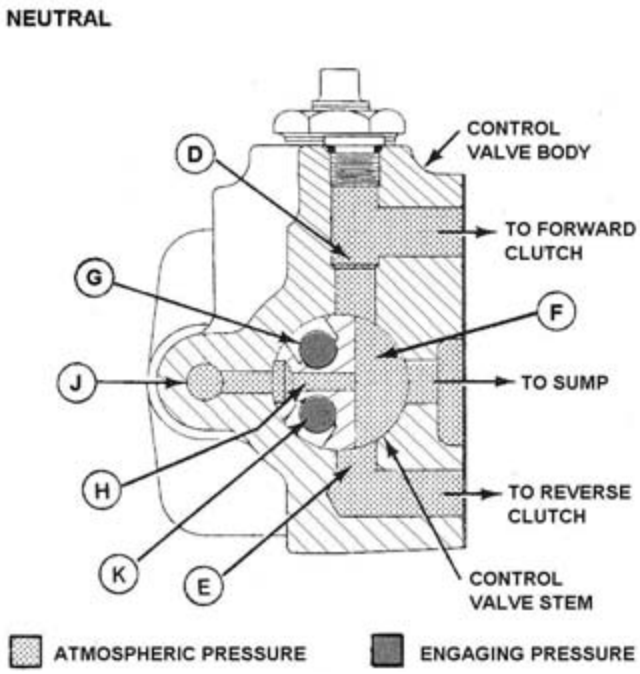


Figure 13. Manual Control Valve — Neutral — Cutaway View

Manual Control Valve — Primary

When a shift to the primary position is desired, the control valve lever is moved. The shift causes the control valve stem to rotate and assume the position indicated in Figures 14 and 15. The pressurized oil in chamber B is directed through ports G and K to passages D and J. Passage D is aligned with a passage directing main pressure oil to the primary clutch. Pressurized oil from port K travels through passage J and enters chamber L through an orifice in the orifice plate. The orifice in this plate meters the oil for a steady, smooth pressure rise in chamber L. As chamber L fills with oil, the pressure rate-control piston moves against the springs until the piston is stopped by a shoulder in the valve body. This causes the pressure in chamber B to rise to clutch engaging pressure. When in primary, passage E remains at atmospheric pressure because slot F remains open to sump.

When a shift is made from primary to neutral, the valve stem is rotated to the position illustrated by Figures 12 and 13. Under these conditions, passage D is connected to sump by slot F. Passage J also is connected to sump by port H in the valve stem. Because passage D is connected to slot F, oil drains rapidly from the primary clutch to sump. Because passage J is now at atmospheric pressure, the oil pressure in chamber L unseats the steel ball against the compression spring permitting a rapid oil drain from chamber L to sump and allowing the pressure-rate control piston to move back against the orifice plate. The primary clutch is now disengaged and main system pressure reduced to neutral pressure.

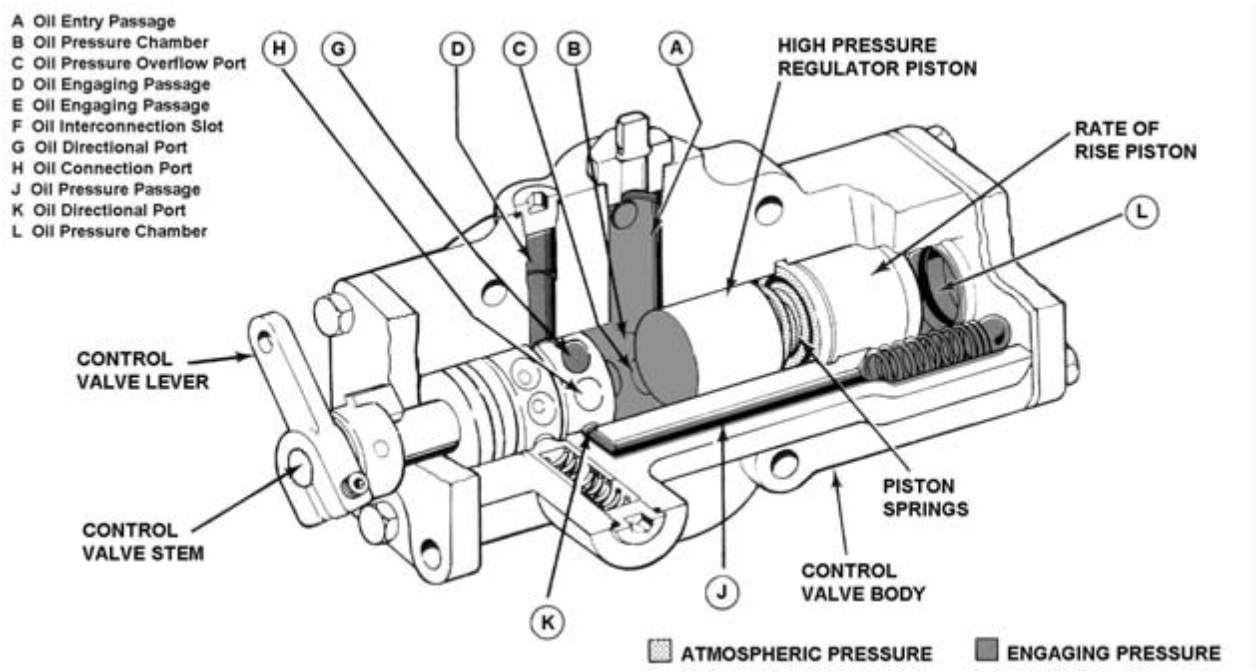


Figure 14. Control Valve — Primary — Sectional View

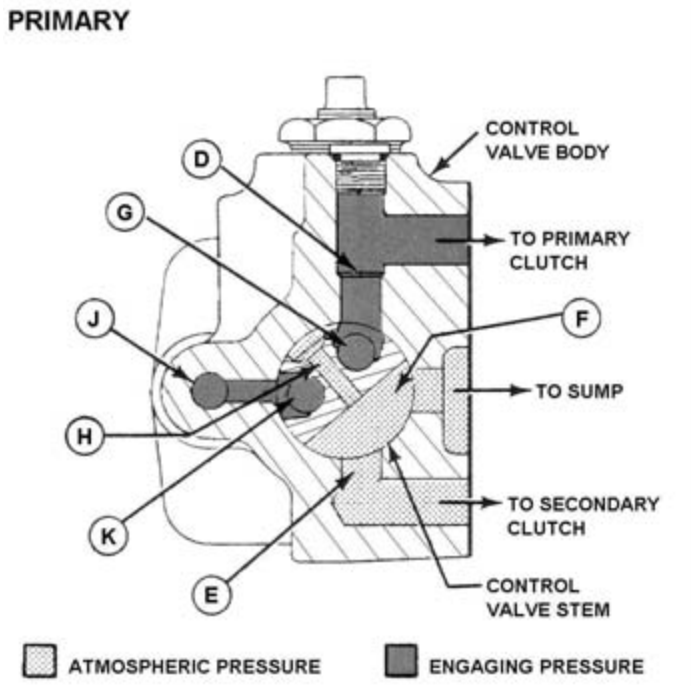


Figure 15. Control Valve — Primary — Cutaway View

Manual Control Valve — Secondary

When a shift to the secondary position is desired, the control valve lever is moved. The shift causes the control valve stem to rotate and assume the position indicated in Figures 12 and 13. The pressurized oil in chamber B is directed through ports G and K to passages E and J. Passage E is aligned with a passage directing main pressure to the secondary clutch. Pressurized oil from port G travels through passage J and enters chamber L through an orifice in the orifice plate.

The orifice in the plate meters the oil for a steady, smooth pressure rise in chamber L. As chamber L fills with oil, the pressure rate control piston moves against springs until the piston is stopped by a shoulder in the valve body. The causes the pressure in chamber B to rise to clutch engaging pressure. When in secondary, passage D remains at atmospheric pressure because slot F remains open to sump. When a shift is made from secondary to neutral, the valve stem is rotated to the position illustrated by Figures 16 and 17. Under these conditions, passage E is connected to the sump by slot F. Passage J is also connected to sump by port H in the valve stem. Because passage E is connected to slot F, oil drains rapidly from the secondary clutch to sump. Because passage J is now at atmospheric pressure, the oil pressure in chamber L unseats the steel ball against the compression spring, permitting a rapid oil drain from chamber L to sump and allowing the pressure rate control piston to move back against the orifice plate. The secondary clutch is now disengaged and main system pressure reduced to neutral pressure.

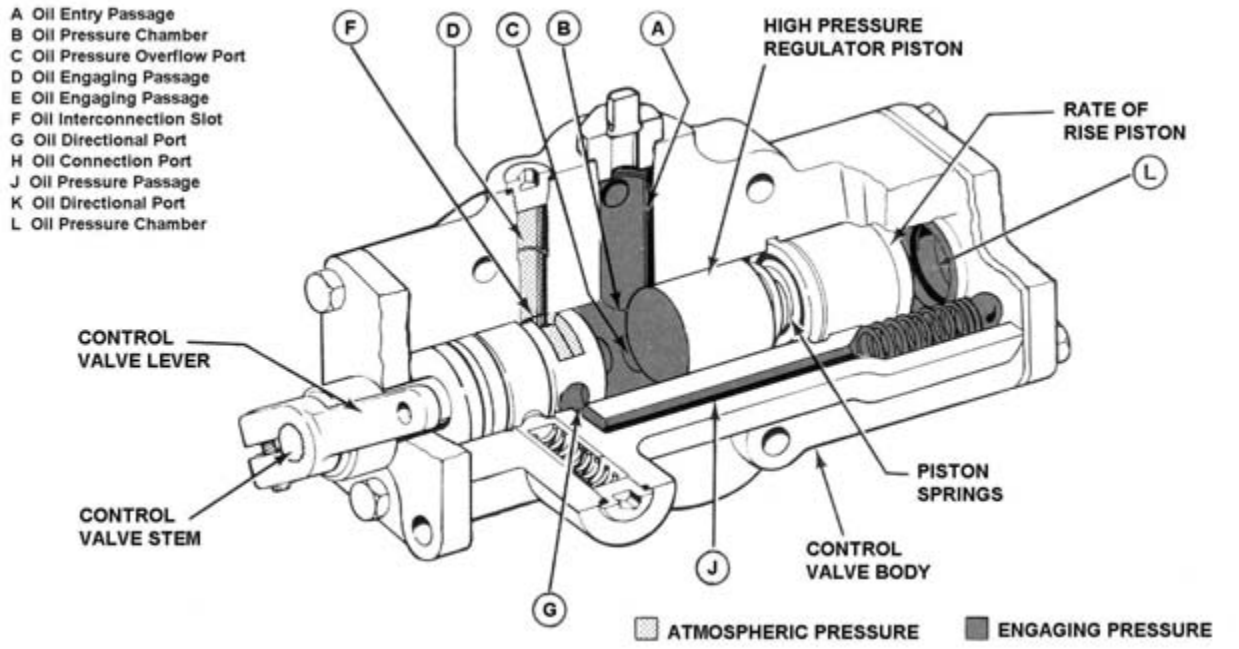


Figure 16. Control Valve — Secondary — Sectional View

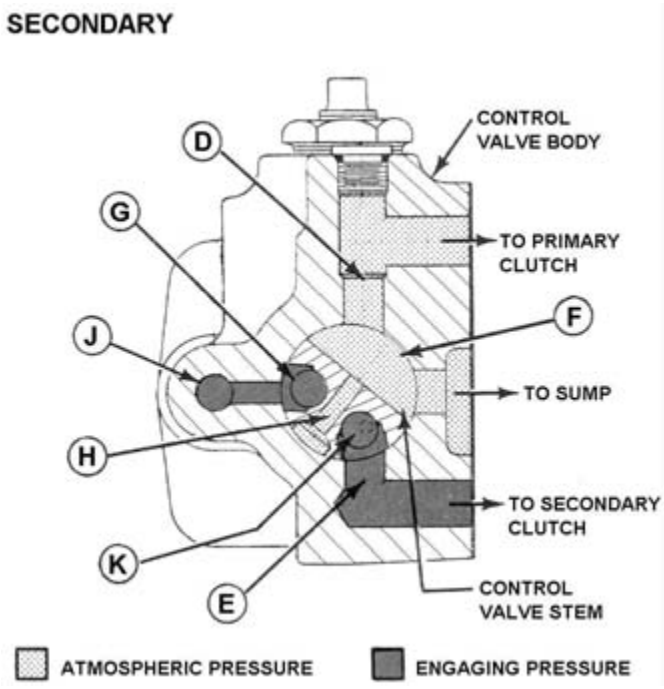


Figure 17. Control Valve — Secondary — Cutaway View

Hydraulic System with Electric Control Valve

The oil pump draws oil through the strainer from the oil sump and discharges it through the heat exchanger and filter to the combination control and pressure-regulating valve. The oil enters the pressure-regulating area of the valve where main pressure is regulated by cascading excess oil into the lubrication oil circuit. Lubrication oil is distributed through fixed controlled orifices to lubricate and cool the clutches and bearings. There is a lubrication oil relief valve to limit the maximum lubrication oil pressure. This pressure is regulated to approximately 690 kPa (100 psi) on the MG-5600, and approximately 827 kPa (120 psi on the MG-5600DR.

In Neutral, the inlet port of both clutches is connected to the atmosphere. Since the area behind the clutch pistons is open to sump, the clutches are disengaged. Oil is distributed through the lubrication system. The area between the pressure regulating piston and the rate-of-rise piston is connected to sump at all times to prevent any leakage oil from affecting the pressure regulation.

The pressure in the rate-of-rise chamber is controlled by a ball that is spring loaded against the orifice plate. The passage behind the ball and spring is connected to the sump (atmosphere) in Neutral and to main pressure when either clutch is engaged. A shuttle ball, connected to both clutch pressure ports, permits pressurizing this passage with oil from the engaged clutch without allowing oil to flow to the disengaged clutch.

The electric control valve can be used in a manual override mode in the event of an electrical power failure.

When the control valve is energized or shifted to engage either clutch, the valve directs main pressure to engage the selected clutch pack. Oil is also directed to move the rate-of-rise piston, compressing the pressure regulator springs. This progressively increases the clutch engaging pressure causing the clutches to engage at a controlled rate.

The control valve allows only one clutch to be engaged at a time, and the oil from the disengaged clutch is vented to sump (atmospheric pressure). The clutch return springs move the disengaged clutch’s piston to the disengaged position minimizing clutch plate drag.

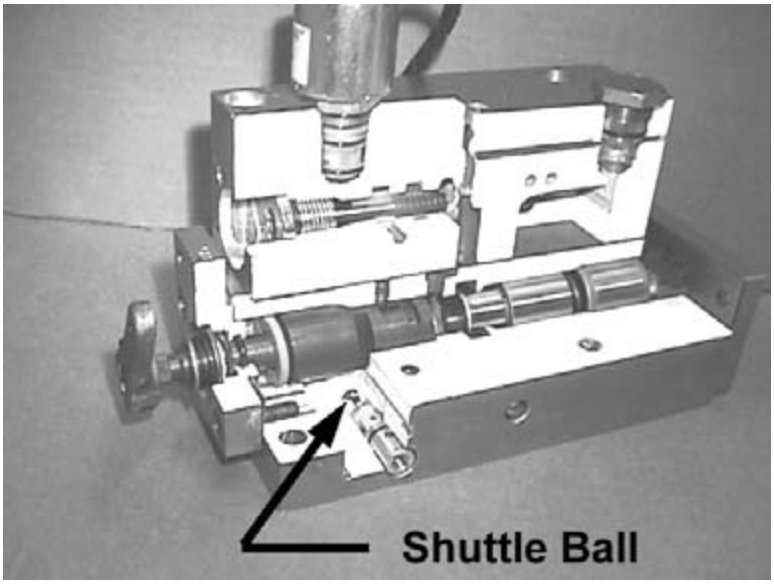


Figure 18. Location of Shuttle Ball

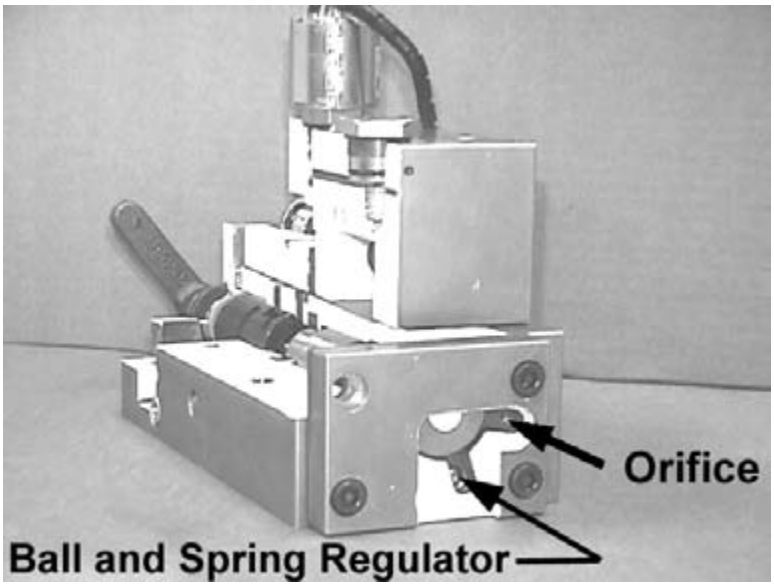


Figure 19. Neutral Regulator and Rate of Rise Orifice

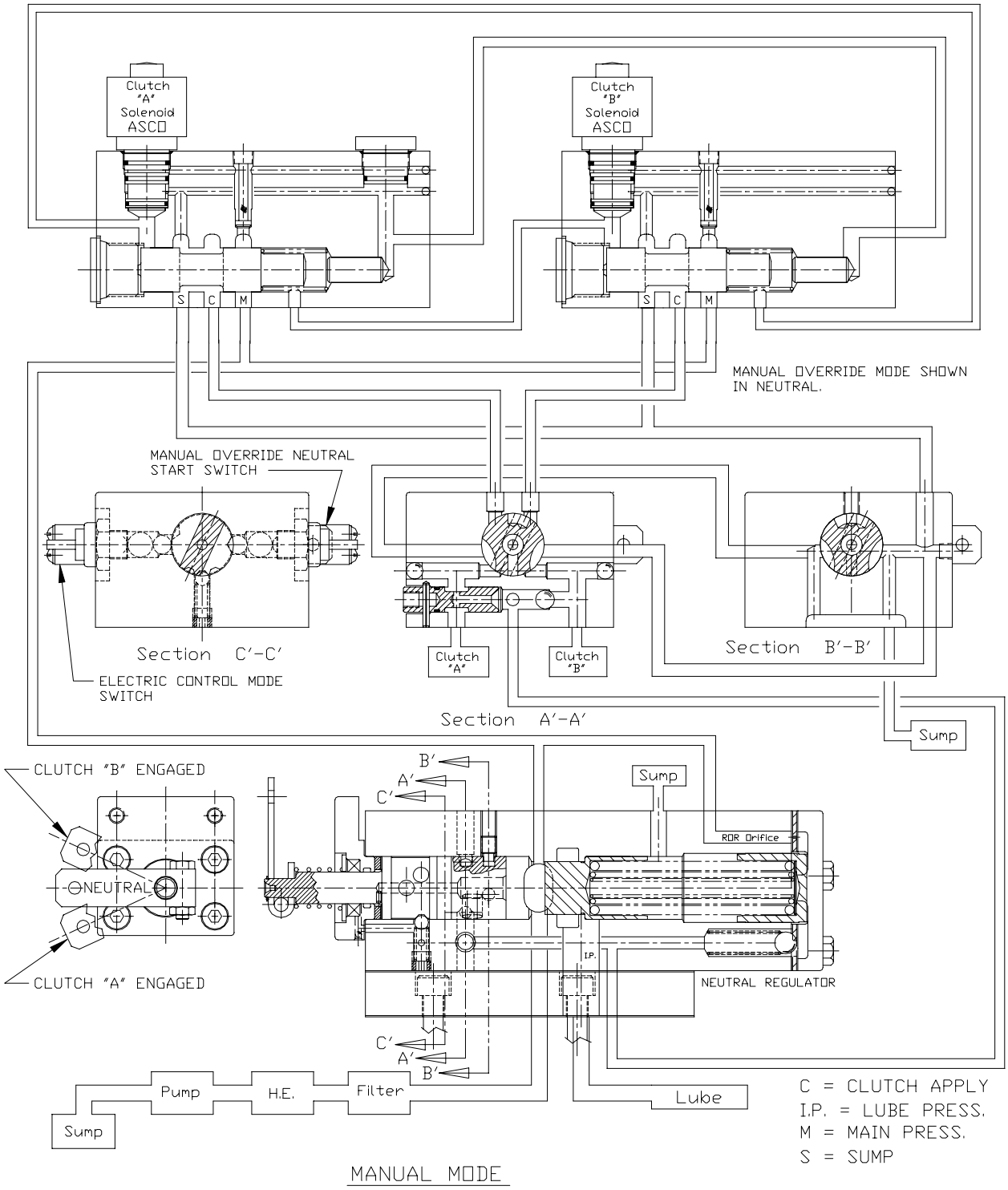


Figure 20. Hydraulic Schematic - Electric Valve in Electric Mode

Control Valve Assembly in Neutral

Some of the main pressure oil from the oil inlet chamber flows through a passage to the orifice in the orifice plate. The small flow of oil through this orifice fills and begins to pressurize the rate-of-rise chamber.

Both clutches are connected to sump when the control valve is in Neutral. Since there is no pressure acting on the shuttle ball from either clutch, the passage behind the ball and spring regulator is also connected to sump. This allows the oil pressure in the rate-of-rise chamber to be regulated by the ball and spring, since the overage oil can flow to sump. The oil pressure in the rate-of-rise chamber acting on the rate-of-rise piston causes it to stroke over partially, which compresses the pressure regulating springs additionally. This additional spring compression further resists the movement of the pressure regulating piston, resulting in a force balance between the area at the pressure regulator, the springs, and the area behind the rate-of-rise piston. Neutral main pressure of approximately 40 psi is maintained by relieving excess oil behind the rate-of rise piston through the ball and spring regulator.

Control Valve Assembly in Primary or Secondary

Pressurized oil is directed to one of the transmission's clutches to engage it. The pressurized oil in the clutch port of the engaged clutch acts on the shuttle ball, sealing off the passage to the opposite clutch. The pressurized oil also forces the ball of the ball and spring regulator against its seat on the orifice plate, stopping the flow of oil from the rate-of-rise chamber to sump. Since oil continues to flow into the rate-of-rise chamber through the orifice, the oil pressure in the rate-of-rise chamber increases. This increased oil pressure forces the rate-of-rise piston to stroke over to its stop in the valve body, compressing the pressure regulating springs even further yet.

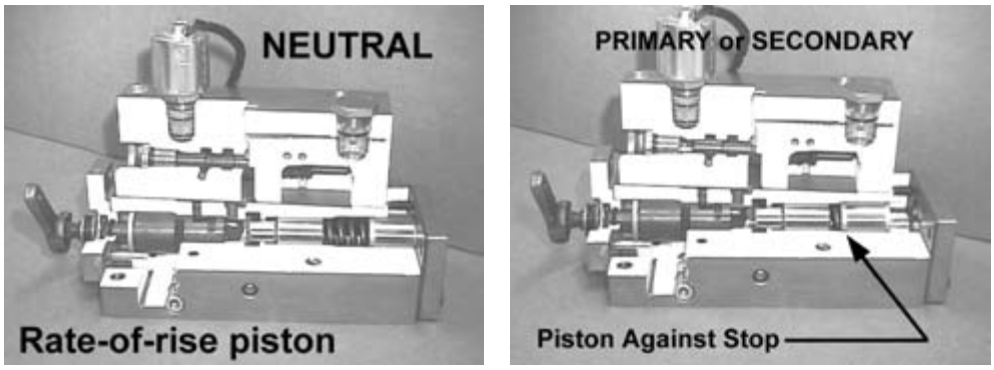


Figure 21. Rate of Rise Piston in Neutral (left) and Rate of Rise Piston with Clutch Engaged (right)

The travel rate of the rate-of-rise piston (and resulting pressure rate-of-rise) is controlled by the orifice size, regulator spring stiffness and the final main pressure after completion of the rate-of-rise cycle. Neutral main pressure controls the start time of the rate-of-rise cycle. When the rate-of-rise piston is against the stop (pressure regulating springs are compressed the most), the main oil pressure reaches approximately 350 psi.

When the control valve is shifted to Neutral, the clutch that was engaged is vented to sump within the valve. As a result, the passage behind the ball and spring regulator is vented to sump and induces a high differential pressure between the rate-of-rise chamber and the passage behind the ball and spring. Since the pressure in the rate-of-rise chamber is much greater than the pressure it is to be regulated at, the ball unseats from the orifice plate, allowing main oil pressure to return to the neutral pressure level rapidly and again be regulated by the ball and spring regulator. The ball returns to the pressure regulating position once the spring force is equal to force induced by the pressure at the rate-of-rise piston.

Electric Operation

The transmission normally operates with the control valve in the electric mode. Two spools, each controlled by a solenoid operated pilot valve, control clutch engagement. When a solenoid is energized, it opens the pilot valve and allows main pressure oil to flow to the end of the spool. The pressure acting on the end of the spool overcomes the return spring at the opposite end, causing the spool to stroke over and connect the clutch passage with main pressure passage.

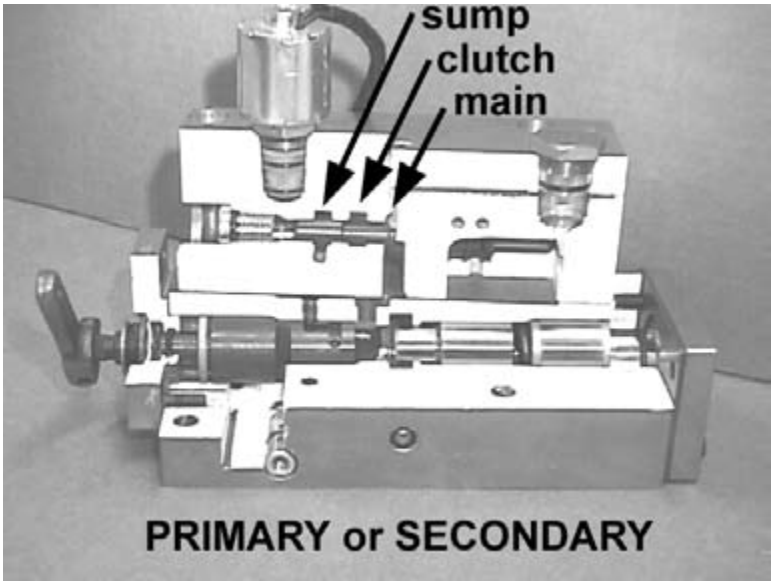


Figure 22. Pilot Spool Passages

Main pressure oil flows from the spools above to the clutch passages of the transmission below via connecting slots in the manual override stem. These connecting slots are aligned with passages in the valve body when the valve is in the electric mode.

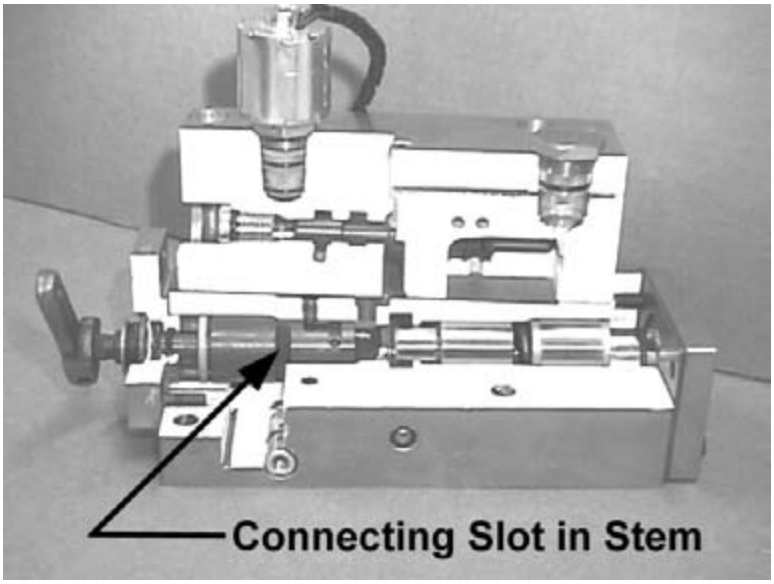


Figure 23. Flow Path in Override Spool

Main pressure from the energized solenoid operated pilot valve also acts on a pin on the return spring side of the opposite spool to ensure the opposite spool is connecting its clutch to sump. The clutch engagement cycle is outlined in the previous section.

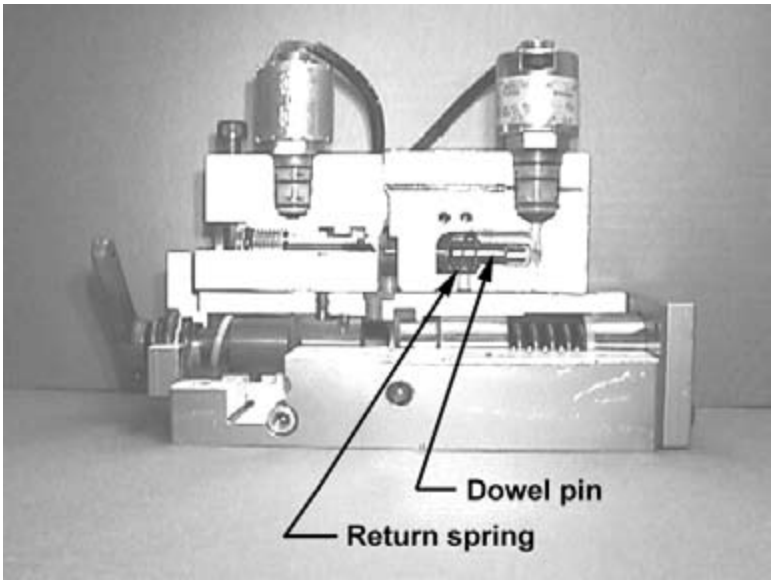


Figure 24. Pin to Prevent Simultaneous Engagement of Clutches

Manual Override Operation

The control valve has a manual override feature, which is a lever operated selector. When the manual override lever is rotated counterclockwise and pulled outwards, the upper portion of the valve is disabled because the connecting slots in the manual override stem are no longer aligned with the oil passages in the valve body. Oil pressure from the solenoid operated pilot valve controlled spools cannot reach the clutch pressure passages in the transmission. The main oil pressure regulator, shuttle ball, neutral pressure regulator, and rate-of-rise functions remain exactly the same as when the valve is in the electric mode. In the manual override position, shifting is controlled by rotating the lever on the manual override stem.

In the Neutral position, both clutches are vented to sump by two pockets in the stem.

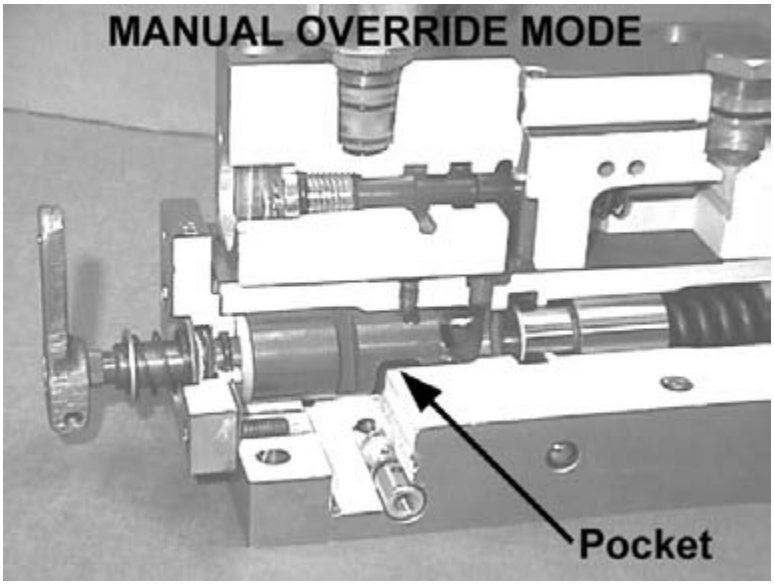


Figure 25. Stem Pocket or Passage

Main pressure oil can flow through the hole in the end of the stem to a narrow slot between the two pockets. This slot does not connect to any other passages when the stem is in the Neutral position.

When the lever and stem are rotated to engage either the primary or secondary clutch, main pressure oil flows through the slot in the stem to the appropriate clutch pressure port. The opposite clutch port passage remains connected to sump by the same pocket in the stem as when the stem was in the Neutral position. When the stem is rotated back to the Neutral position, the main pressure oil slot in the stem is no longer aligned with either clutch port. Both clutches are again vented to sump by the two pockets in the stem.

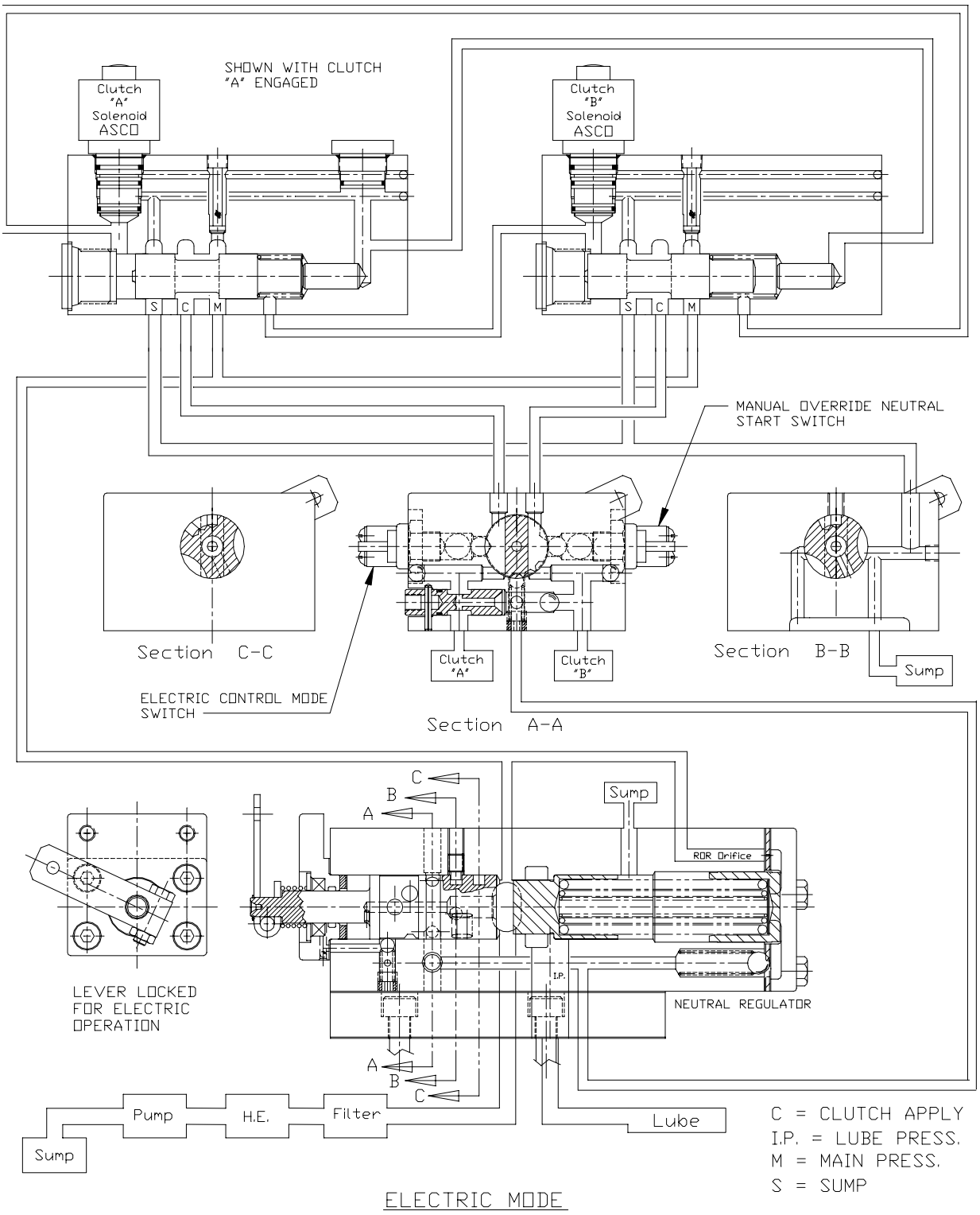


Figure 26. Hydraulic Schematic - Electric Valve in Manual Mode

Live PTO (Optional)

The live PTO drives accessories using engine horsepower. Since the live PTO connects the accessory to the primary shaft of the transmission via a direct coupling, the accessory is driven when the engine is running.

Trailing Pump (Optional)

The trailing pump supplies oil flow to the transmission lubrication circuit when the output shaft is rotating. This lubrication oil is required when the transmission is in a backdriving condition. Backdriving (sometimes referred to “windmilling”) occurs when the engine is shut down and the transmission output shaft is being driven by water flow across the propeller. When the engine is running and the output shaft is rotating, oil flow from the trailing pump supplements the oil flow supplied to the lubrication circuit by the main oil pump.

The trailing pump is driven by an electric motor, and oil flow from the trailing pump flows through a check valve into the oil inlet of the heat exchanger and into the transmission lubrication circuit.

Power Flow

Neutral

When in neutral the primary and secondary shafts, transfer gears and clutch friction plates rotate at engine speed. Other parts including the output shaft do not turn.

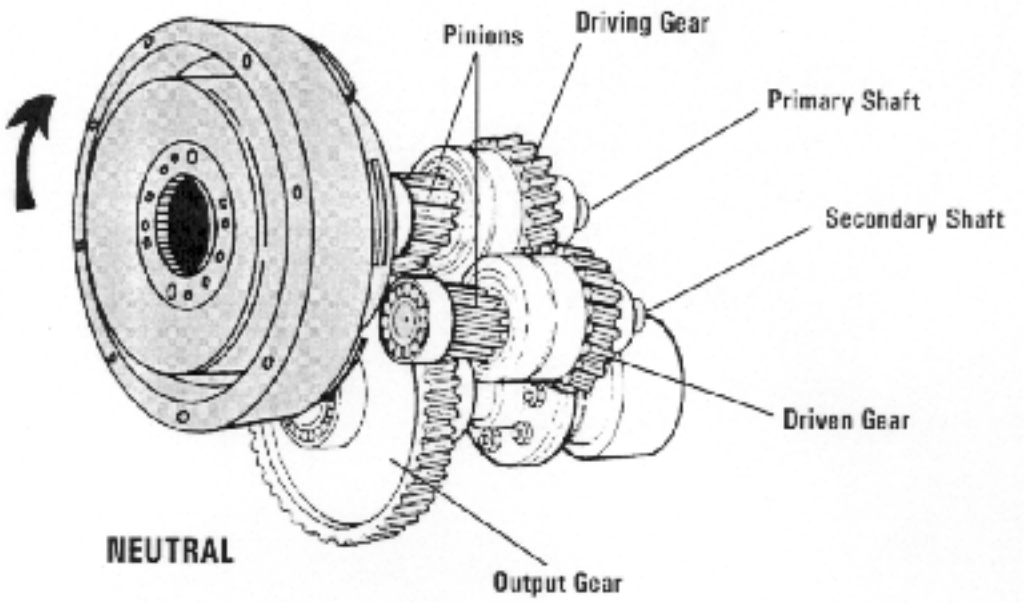


Figure 27. MG5600 Power Flow in Neutral

Model MG5600DR

The input gear reduction set is driven by the engine, and in turn, rotates the same components as in the MG5600, but in the opposite direction if used with the same engine type. The rotational speed of these components will be either 72%, 77%, or 84% of engine rpm dependent on the input reduction ratio of the transmission.

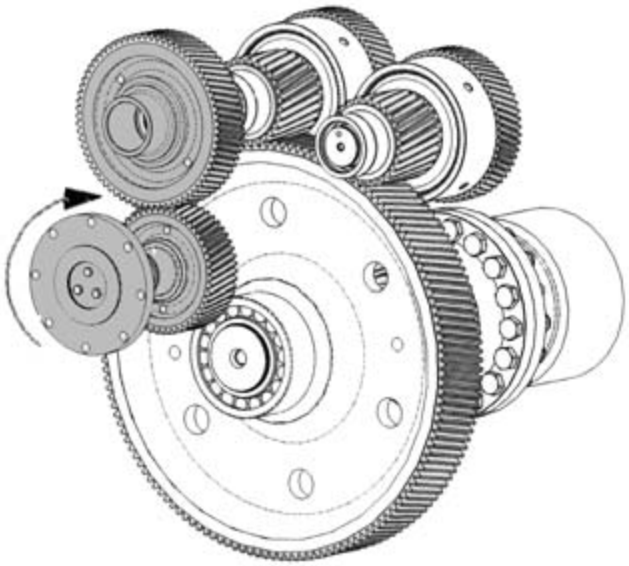


Figure 28. MG5600DR Power Flow in Neutral

Primary

When the primary position is selected, hydraulic pressure is applied to the primary clutch piston clamping the friction and steel clutch plates together. The primary input pinion will then rotate at engine speed and direction because the steel plates are spline-connected through the clutch hub assembly to the pinion. Because the primary input pinion is in mesh with the output gear, the output gear and shaft will rotate in anti-engine direction. The secondary input pinion will be backdriven (engine direction) when the unit is in the primary position.

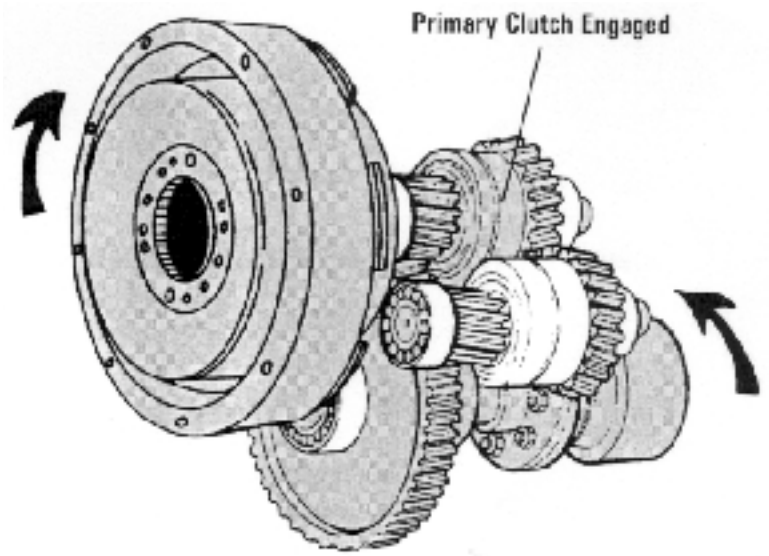


Figure 29. MG5600 Power Flow with Primary Clutch Engaged

Model MG5600DR

When the primary position is selected, hydraulic pressure is applied to the primary clutch piston clamping the friction and steel clutch plates together. The steel clutch plates are spline connected through the clutch hub assembly to the input pinion, so the primary input pinion will rotate at either 72%, 77%, or 84% of engine rpm dependent on the input reduction ratio of the transmission and in the opposite direction. Because the primary input pinion is in mesh with the output gear, the output gear and shaft will rotate in the engine direction. The secondary input pinion will be backdriven (opposite engine direction) when the unit is in the primary position.

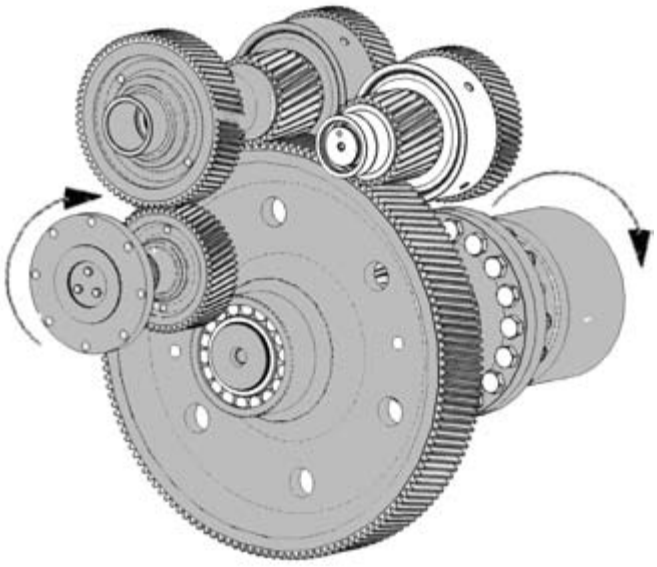


Figure 30. MG5600DR Power Flow with Primary Clutch Engaged

Secondary

In secondary, the same parts are turning that were turning in neutral. When the secondary position is selected, hydraulic pressure is applied to the secondary clutch piston clamping the friction and steel plates together. The secondary input pinion will then rotate at engine speed and anti-engine direction, because the steel clutch plates are spline connected through the clutch hub assembly to the input pinion. Because the secondary input pinion is in mesh with the output gear, the output gear and shaft will rotate in engine direction. The primary input pinion will be backdriven (anti-engine direction) when the unit is in the secondary position.

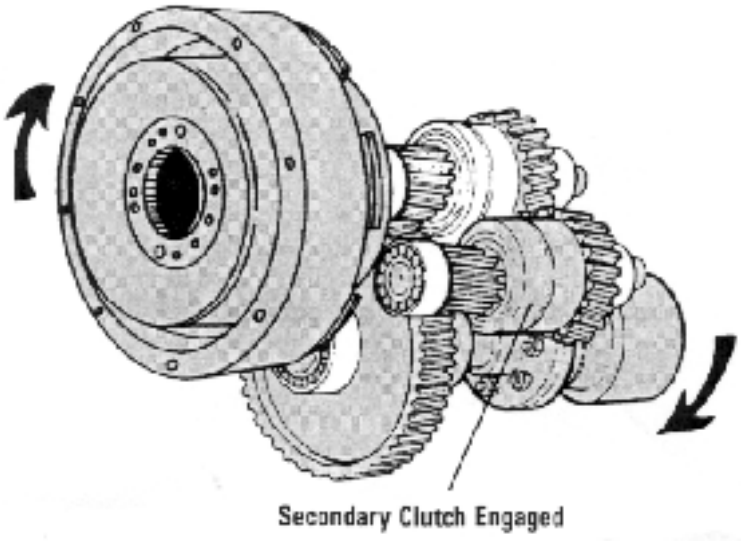


Figure 31. MG5600 Power Flow with Secondary Clutch Engaged

Model MG5600DR

In secondary, the same parts are turning that were turning in neutral. When the secondary position is selected, hydraulic pressure is applied to the secondary clutch piston clamping the friction and steel plates together. The steel clutch plates are spline connected through the clutch hub assembly to the input pinion, so the secondary input pinion will rotate at either 72%, 77%, or 84% of engine rpm dependent on the input reduction ratio of the transmission and in engine direction. Because the secondary input pinion is in mesh with the output gear, the output gear and shaft will rotate opposite engine direction. The primary input pinion will be backdriven (engine direction) when the unit is in the secondary position.

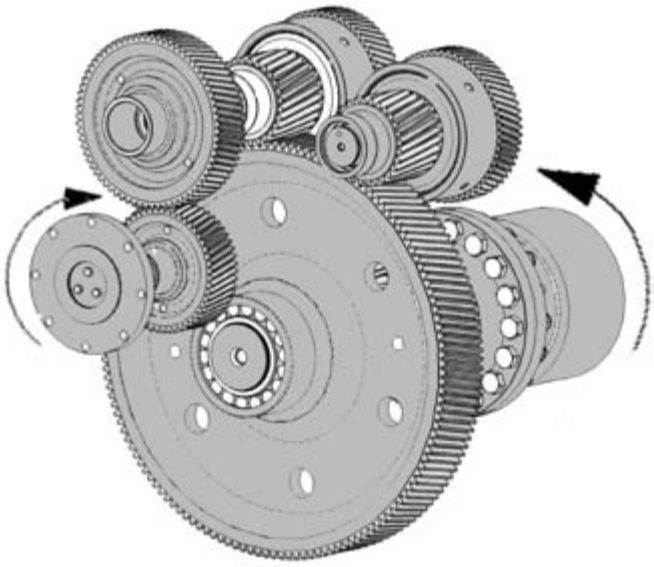


Figure 32. MG5600DR Power Flow with Secondary Clutch Engaged

Preventative Maintenance

In-boat Maintenance and Repair

Certain transmission maintenance/repair procedures can be accomplished in the boat provided sufficient space exists to work. These procedures are:

- ❑ Removing and installing the oil pump.
- ❑ Changing the filter.
- ❑ Removing, cleaning and installing the suction strainer.
- ❑ Removing and installing the control valve.
- ❑ Removing and installing the manifold or top cover, bearing carrier and lube tube.
- ❑ Removing and installing the primary and secondary shaft assemblies.

Note: See special tools section for lifting bracket to aid in shaft removal or installation.

- ❑ Changing primary and secondary clutch plates.

Note: Further disassembly/reassembly of the primary or secondary shafts will require use of tools and equipment normally not available on board the vessel.

General Maintenance

Lubrication

Grease the oil seals on the output end of the output shaft through the grease fitting with water pump (lithium soap-based NLGI No. 2) grease. Apply grease every 100 hours or when the boat is docked.

No other lubrication is required beyond the daily oil check.

Oil System

Oil Level

The oil level should be checked daily or every 10 hours. Check oil level before starting the engine to confirm that the transmission has oil in it. With the engine running at low idle and the transmission in Neutral, check the oil again. The oil level should be near the “low” oil level mark. Transmission oil temperature should be in the normal operating range prior to finalizing the oil level between the low and full marks on the oil level gauge.

Oil and Filter Change Interval

With a new transmission, change the oil and filter element within the first 50 hours of operation. Change oil and filter element after each 1000 hours thereafter or more often if conditions warrant.

For a rebuilt transmission, check the filter element after eight hours of operation. If the filter is clean, install a new filter element and then change the oil and filter element after 1000 hours of service. If the filter is dirty, change the element and operate for another eight hours. Check the filter again. Continue this cycle until the filter is clean and then change the oil and filter after 1000 hours of service or more often if conditions warrant.

Draining

Drain the transmission by removing the O-ring plug at the rear side at the bottom.

Oil Suction Strainer

Remove and clean the pump suction strainer at every oil change or sooner if necessary. The suction strainer is located in the oil suction tube below the pump. See Engineering Drawings for suction strainer location.

Type Oil Recommended

See Description and Specifications.

Filling

1. Remove the filler breather in the top cover of the transmission.

2. Fill the transmission's sump with 110 liters (29 U.S. gal.) of the proper weight and type oil. See Description and Specifications for oil recommendations.

3. Start the engine and let it idle with transmission in neutral until oil is circulated throughout the hydraulic system. Add oil if necessary to bring the oil level up to the "low" mark with the engine at low idle.

4. With the oil at operating temperature, transmission in neutral, and the engine running at low idle, check the oil level with the oil gauge. Add or remove oil if necessary to bring the oil level to "FULL" mark on the oil gauge.

5. Allow the oil temperature to cool to normal cold oil conditions (perhaps overnight). Check the oil level while cold at low idle engine speed while in neutral. Make note of the oil level in the cold conditions for future reference, as it corresponds to the correct oil level at operating temperature.

Torsional Coupling

Do not obstruct the flywheel housing vents preventing the free flow of air for cooling the coupling. The ambient temperature of the air around the coupling should be between -6°C (22°F) and 80°C (176°F). Assure baffles are installed properly so hot air is ported out of the housing.

Visually inspect the element after the first 100 hours of operation and every 2000 hours thereafter, or every six months, whichever comes first. Torsional vibration, misalignment, degradation by contaminants (oil), heat, ultraviolet radiation, and excessive system torque can cause cracks or other signs of distress to appear on the surface of the rubber. The above-described items affect the life of the coupling element.

When inspecting the flexible coupling, look for evidence or conditions identified in the following steps:

- ❑ Cracks in the surface of the rubber. May be caused by torsional vibrations, excessive misalignment or exposure to contaminants (heat, petroleum products, chemicals, ozone, ultraviolet radiation, etc.) excessive system torques.
- ❑ Separation of rubber from flex plate on coupling plate or deterioration of the rubber-to-metal bond. See above.
- ❑ Deterioration of the rubber element, as evidenced by sponginess or by black carbon-like dust on rubber surface. May be caused by contaminants or excessive heat, either external or internal to the coupling.
- ❑ Cracked, bent or otherwise damaged flex plate or coupling plate.
- ❑ Bolt holes in flex plate or coupling plate elongated oval shaped, not round. This could be caused by improperly assembled parts, loose parts, vibration or improperly torqued parts.
- ❑ Bolts/nuts—bent, worn or stripped threads.

Inspect the hub, looking for the following:

- ❑ Damaged or worn splines.
- ❑ Cracked parts.
- ❑ Oil seal surface for wear or damage.

Replace any defective parts including defective fasteners that are found.

Heat Exchanger Check

Heat exchangers furnished by Twin Disc to be used for salt water applications have zinc rods installed at the inlet and outlet heads. These rods must be checked every 90 days. If over 50% of the rod is disintegrated, it should be replaced to provide effective protection.

Excessive corrosion of the zinc rod indicates electrolytic action. A careful inspection should be made to determine if this action is caused by a short circuit or external grounded electric current. If these conditions do not exist, it is evident that the corrosion is due to local electrolysis. If rods are corroded with foreign materials, they should be cleaned with a wire brush.

Overhaul Interval

A complete overhaul of the unit should be made at the same time that the engine is overhauled.

Periodic Visual Inspection

- ❑ Check the mountings for tightness or damage such as cracks. Tighten loose mountings and replace damaged parts.
- ❑ Check pressure and temperature gauge where applicable.
- ❑ Inspect the oil lines and heat exchanger for leaky connections, cracks, or other damage. Replace damaged lines.
- ❑ Periodically, inspect the drive line and the input and output shaft oil seals for leakage. Replace parts as required.

Troubleshooting

Troubleshooting Chart

The following chart is intended as a guide for determining the cause of problems that could be encountered and the corrective actions for those difficulties.

The transmission is one part of a complete power package. Problems in the input power system or the output power delivery components can cause problems to develop in the transmission. It is therefore important that the entire power package be considered when problems are encountered.

Tables begin on the next page.

Table 14. Troubleshooting Chart

Symptom	Cause		Remedy	
1. Low main oil pressure	1-1	Partially clogged oil strainer	1-1	Remove and clean oil strainer.
	1-2	Stuck pressure regulation piston.	1-2	Disassemble the valve and clean the piston.
	1-3	Broken piston rings on clutch shaft(s).	1-3	Remove the collector and inspect piston rings.
	1-4	Damaged or worn oil pump assembly.	1-4	Replace damaged or worn oil pump assembly (pump is not serviceable)
	1-5	Incorrect linkage adjustment to control valve assembly.	1-5	Adjust linkage so that control valve stem is indexed properly by detent.
	1-6	Clogged or plugged orifice in orifice plate of control valve assembly.	1-6	Remove orifice plate cover. Clean parts.
	1-7	Shimming required between regulator springs and rate-of-rise piston.	1-7	Shim as required.
	1-8	Engine idle speed too low.	1-8	Raise engine speed.
2. No oil pressure, or erratic low pressure at control valve tap.	2-1	Oil pump suction strainer plugged.	2-1	Remove and clean strainer.
	2-2	Oil level low.	2-2	Check oil level and correct.
	2-3	Air leak on suction side of pump.	2-3	Correct cause of air leak.
	2-4	Pump drive on reverse clutch shaft broken.	2-4	Disassemble and repair as required.
	2-5	Regulating valve stuck in open position	2-6	Remove, disassemble, clean and repair the regulating valve.
	2-6	Oil pump defective	2-7	Replace oil pump.
	2-7	Leaking heat exchanger has caused oil to be lost over board.	2-7	Replace heat exchanger

Table. 14. Troubleshooting Chart (continued)

Symptom	Cause		Remedy	
3. High main oil pressure.	3-1	Regulating valve stuck.	3-1	Remove and clean regulating valve.
	3-2	Improperly shimmed.	3-2	Shim as required.
	3-3	Lube relief valve malfunction.	3-3	Inspect, repair or replace parts as necessary.
4. High temperature.	4-1	Improper oil level.	4-1	Check and fill (or drain) with proper oil to the correct level.
	4-2	Faulty heat exchanger	4-2	Inspect, repair, or replace heat exchanger.
	4-3	Clutches slipping	4-3	Check clutch apply oil pressure. If pressure is normal, remove, disassemble, and repair slipping clutch.
	4-4	Bearing failure.	4-4	Overhaul marine transmission.
	4-5	Air leak on suction side of pump.	4-5	Inspect and correct cause of suction leak.
	4-6	Control valve malfunction	4-6	Inspect, repair, or replace control valve.
5. Excessive Noise	5-1	Bearing failure.	5-1	Overhaul marine transmission.
	5-2	Worn or damaged input coupling.	5-2	Remove marine transmission. Replace a worn or damaged coupling.
	5-3	Excessive torsional vibration.	5-3	Select proper torsional coupling.
	5-4	Worn or damaged gears.	5-4	Overhaul marine transmission.
	5-5	Improper alignment.	5-5	Check alignment of engine and transmission output flange to propeller shaft. Correct as necessary.
	5-6	Damaged propeller.	5-6	Repair propeller.
	5-7	Misfiring engine.	5-7	Repair engine.

Table. 14. Troubleshooting Chart (continued)

Symptom	Cause		Remedy	
6. No neutral.	6-1	Clutch plates warped.	6-1	Remove clutch plates. Overhaul unit.
	6-2	Control valve incorrectly indexed.	6-2	Check and adjust control linkage.
	6-3	Solenoid malfunction (units equipped with electric selector valve)	6-3	Replace defective solenoid.
	6-4	Hydraulic lock piston stuck (units equipped with electric selector valve and hydraulic lock).	6-4	Inspect, repair, or replace hydraulic lock spool.
7. Harsh engagement.	7-1	Regulating piston or rate-of-rise piston stuck.	7-1	Disassemble control valve. Clean parts. Replace parts if necessary.
	7-2	Orifice plate ball in control valve not seating properly.	7-2	Remove orifice plate cover. Clean parts. Replace parts if necessary.
	7-3	Blown gasket on either side of orifice plate.	7-3	Replace gasket.
8. Low lube oil pressure.	8-1	Pump flow output too low.	8-1	Replace pump.
	8-1	Pump suction strainer plugged.	8-2	Remove, clean, inspect, and install the suction screen.
	8-3	Air leak on suction side of pump.	8-3	Inspect and correct cause of suction leaks.
	8-4	Lube relief valve malfunction.	8-4	Remove and clean or replace parts as necessary.
	8-5	Broken piston rings.	8-5	Replace damaged piston rings.
9. Oil spilling out of breather.	9-1	Oil level too high.	9-1	Adjust oil level.
	9-2	Wrong type of oil.	9-2	Draw and refill with recommended oil.

Disassembly

The following procedure is for complete disassembly of the unit. Prior to this procedure, the transmission should be removed from the boat. Qualified personnel should do the work in a fully equipped facility.

Prepare Transmission for Disassembly

Note: During service of this unit, all O-rings, gaskets and seals must be replaced. It is good practice to keep the old o-rings, gaskets and seals with the appropriate components being disassembled for future reference during the inspection and assembly process (to make sure you don't forget the quantity, size, etc.).

Drain the oil from the transmission sump by removing the M33x2 hex plug from the bottom of the rear side of the housing. Drain the oil from the heat exchanger by removing the pipe plug from the bottom of the heat exchanger shell.

The physical size and weight of many of the parts for this transmission assembly are such that adequate lifting devices and procedures are necessary for safety considerations. This requires that the transmission assembly be adequately supported and properly positioned as identified in the following paragraphs.

Remove Transmission External Components and Sub-Assemblies

All Assembly Models

1. Disconnect and remove the hoses. Identify for ease of reassembly.
2. Remove the heat exchanger.
3. Remove the suction tube from the pump, and remove the suction tube and screen.
4. Remove the pump from the transmission. Remove the pump drive coupling assembly.
5. Remove the oil filter element, and remove the filter head from the transmission.
6. Remove the selector valve and gasket. Set it aside for further disassembly.
7. Remove the oil level dipstick and tube from the top cover.
8. Remove the top cover and gasket.
9. Loosen, but do not remove the four capscrews from the front of the transmission near the output shaft that retain the output gear pan assembly.

Assembly 1016001 or 1017614 Model MG-5600 (free standing)

Remove the three M12-1.75x25 capscrews, washer, and coupling hub if not already removed. The hub is a press fit onto the shaft, and will require the use of a puller to remove. It should not be necessary to place the transmission on rear side.

Assembly 1015239 Model MG-5600 (close coupled)

Note: It may be advantageous to use wood blocks to support the transmission with the input side facing up to remove the input elements due to their weight and size.

1. Remove the input coupling if applicable. This coupling is a slip fit on the input shaft, and should easily slide off.

2. Remove 18 or 26 (depending on housing size) of M16-2.00x45 capscrews, and remove the engine flywheel housing cover

Assembly 1018100 Model MG-5600DR (free standing)

Note: It is necessary to use wood blocks to support the transmission with the input side facing up. Use caution to avoid damaging the output flange

1. Remove three M12-1.75x25 capscrews, washer, and coupling hub. The hub is a press fit onto the shaft, and will require the use of a puller to remove.

2. Remove 16 of M12-1.75x40 capscrews, and remove the seal carrier with shims from the input location, and the cover plate, retainer and shims from the upper location.

3. Remove 28 of M12-1.75x40 capscrews, and insert two of them into threaded holes to use as jacking screws. These threaded holes are located near the top and bottom of the housing near the aligning dowel pins. Remove the housing, taking care that the two bearing cups do not become damaged from falling out. They are a loose fit in the bore of the housing.

4. Remove the drain hose from the input reduction housing to the main housing.

5. Remove both gears from the reduction housing.

6. Remove eight of M16-2.00x60 and nine of M16-2.00x110 capscrews with washers and remove rear reduction housing.

All Assembly Models

Note: It is necessary to block and support the transmission with the output side facing up. Use caution to avoid damaging the spline on the shaft. It will be advantageous to block in such a manner that the four capscrews that were previously loosened are accessible for removal at a later time. The MG-5600 and MG-5600DR requires the use of a SKF THAP 300 oil Injection Kit (see Special Tools) or similar device to remove the output flange and output shaft.

1. Loosen the three output flange capscrews (M24-3.00x65) approximately 5 turns each. The capscrews and washer will retain the output flange when it separates from the output shaft.

2. Install the oil injector into the output flange. Note that these are special 1/4-19 BSP threads.

Figure 33. Output Flange Injection Location

⚠ WARNING

Always use retainer bolts or a safety strap to hold parts being separated with oil pressure. The parts may separate with extreme force.

3. Inject oil with a viscosity of 900 mm^2/S (900 cSt) at room temperature into the hub until it lifts the output flange off the output shaft taper. Remove the three capscrews and washer, and remove the output flange.

4. Remove twenty-two of M12-1.75 capscrews securing the manifold to the bearing carrier and housing. Note that on the MG-5600, there are fourteen screws 50 mm long, and eight screws 70 mm long, and on the MG-5600DR, there are fourteen screws 70 mm long, and eight screws 90 mm long. The rear bearings on the clutch shafts, and the bearing retainer and shim packs are different between the MG-5600 and MG-5600DR units.

5. Install two of the removed screws into the threaded pusher screw holes in the manifold. Use the screws to separate the manifold from bearing carrier. Remove the manifold and gasket.

6. Remove the lube tube, and then remove the bearing retainers and shims from the bearing bores in the bearing carrier for the primary and secondary shafts. Note that the shims are contained between the bearing and the bearing retainer on the MG-5600DR, and not on the MG-5600. The lube oil pressure relief valve on the MG5600 is attached to the bearing retainer by two capscrews. Remove these two capscrews (M8-1.25x16), and remove the valve housing, ball, and spring. The lube oil relief valve on the MG-5600DR is non serviceable, and is a slip fit into a cavity in the bearing retainer and will easily slip out. The bearing cups are a loose fit in the bearing retainer, and may fall out or remain on the bearing cone.

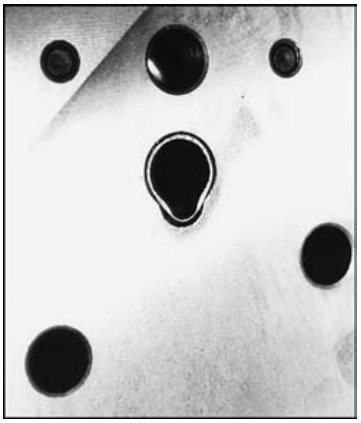


Figure 34. Lube tube Location in Bearing Carrier

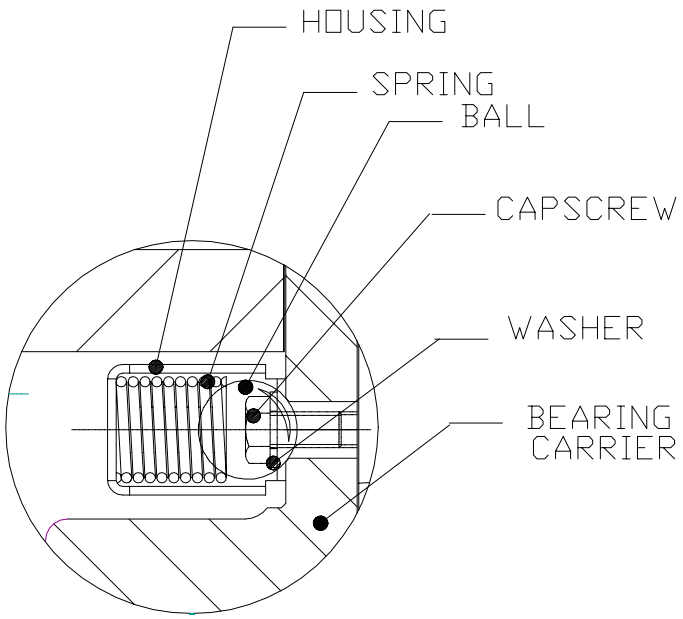


Figure 35. MG-5600 Lube Relief Valve

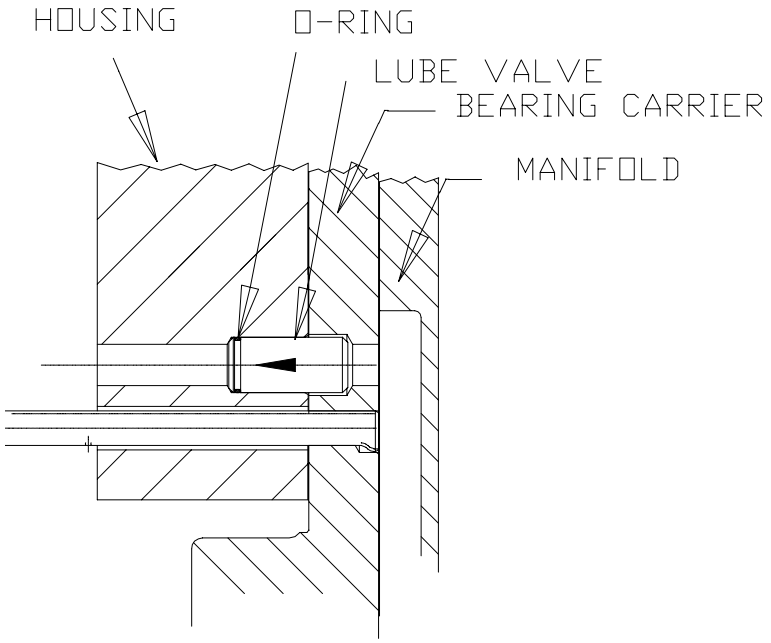


Figure 36. MG-5600DR Lube Relief Valve

7. Lift out the primary and secondary shafts using tools T-18050-726 and T-18050-727. (Disassembly of the primary and secondary shafts are covered later in this section.) Use caution with the front pinion bearing cones. They are loose on the pinion diameter, and should remain in the housing. On some ratios, the diameter of the output gear will allow the bearing to come out with the shaft, and it could easily fall off causing damage. Set the shafts aside for further disassembly.

8. The four capscrews and washers on the front of the housing near the output shaft (these were loosened prior to locating the transmission on its front face) can now be removed. Rotate the output gear until the oil pan is accessible to be removed through the opening in the top of the transmission.

Figure 37. Location of Four Bolts for Oil Pan

9. Remove the eight M16-2.00x45 capscrews and the rear output bearing retainer with the bearing cup and the shims.

10. Use a hoist and lift the output shaft and gear until the gear contacts the housing. Place blocks under the gear to hold it in a position where the front of the output shaft is clear of the front output shaft bearing.

11. Remove the front pinion bearings if they were not previously removed.

12. Connect the oil injection equipment to the 1/4 - 19 BSP threaded port on the rear end of the output shaft.

13. Install eyebolts into the end of the output shaft and into the main housing mounting pads.

14. Thread a heavy strap through the eyebolts in the output shaft and the strap to the eyebolts in the main housing. The strap will retain the output shaft during disassembly.

⚠ WARNING

Always use a safety strap to hold parts being separated with oil pressure. Parts may separate with extreme force.

15. Inject oil with a viscosity of 900 mm^2/S (900 cSt) at room temperature into the output shaft until the shaft and gear separate.

    Note: To prevent damage to the housing, shaft and bearings the output gear should be supported with blocks.

16. Remove the output shaft, and set aside for further disassembly.

17. Install special tool T-19987 (1 through 6) to hold the output gear in position.

18. Stand the transmission upright and remove the output gear through the top opening.

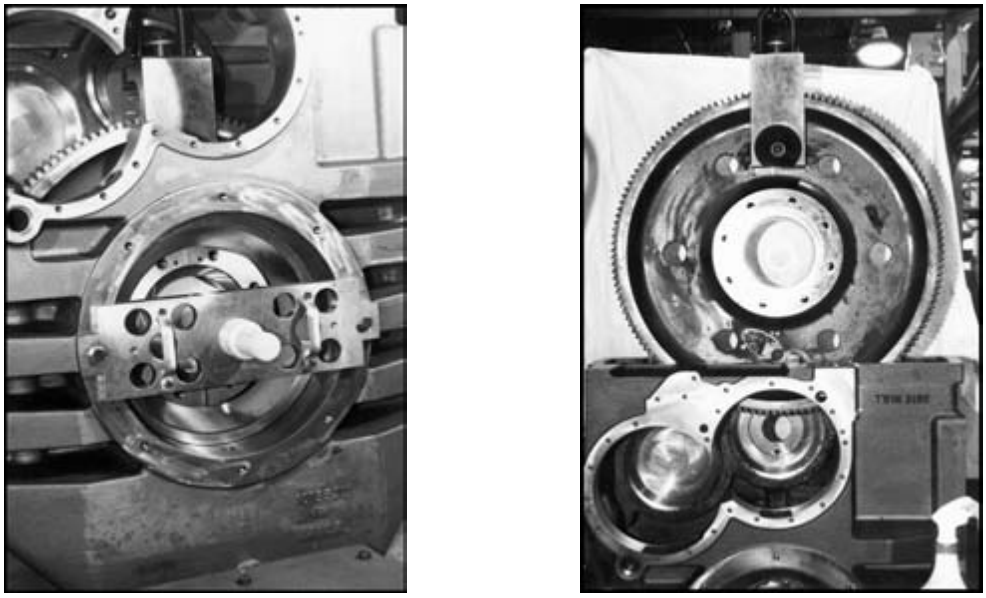


Figure 38. Special Tool T-19987 (left) and Lift Gear from Housing (right)

19. Lay the transmission on blocks, with the output side up. The outer races for the front bearings on the primary pinion and the secondary pinion are an interference fit in their respective bearing bores. If the bearing races must be replaced, use an electric welder and weld a light bead around the I.D. of each bearing race. This will shrink the race and destroy the bearing, but will facilitate removal.

20. Remove the snap ring and remove the front output bearing from the housing. Remove the front output end tapered roller bearing cup from the housing. Pusher bolt holes are provided in the housing.

Disassemble Components and Sub-Assemblies

Output Shaft

Use a hydraulic press to remove the rear output bearings from the output shaft.

Note: In some situations, the rear tapered roller bearings on the output shaft can be rebuilt at the time of a regular transmission rebuild. Contact a local Timken distributor for bearing rebuild information.

Primary and Secondary Clutch Shaft

Note: The procedure for both shafts is nearly identical. Differences are noted.

1. Remove the two M8-1.25x20 socket head capscrews and remove the oil pump adapter (Secondary shaft).

2. Remove the two piston rings from the rear end of the shaft.

3. Do not remove the rear bearing unless the bearing must be replaced. This bearing is an interference fit with the shaft and will be destroyed during removal. If the rear bearing must be replaced, remove the bearing retaining snap ring from rear end of shaft. Use a hammer and chisel to cut the bearing cage, and remove the bearing cage and rollers. Use a split-type bearing puller (cheese cutter) to grip the flange at the small end of the tapered inner race, and using a hydraulic jack or puller, pull on the bearing inner race while pushing on the rear end of the shaft to remove the bearing inner race from the shaft.

4. Support the shaft assembly solidly on the rear face of the transfer gear with the input end up.

5. Remove the round retaining ring from the input end of the shaft and remove the pinion from the shaft.

Figure 39. Remove Round Retaining Ring

6. The straight roller bearing in the bore of the input end of the pinion is a tight fit, and will likely be destroyed during removal. Remove the internal snap ring from the input end of the pinion and remove the straight roller bearing with the use of a puller behind the roller ends
.
7. Do not remove the rear tapered roller bearing outer race from the bore at the rear of the pinion unless the bearing must be replaced. This bearing is an interference fit with the pinion and will be destroyed during removal. If it must be replaced, use an electric welder to weld a light bead around the I.D. of the bearing race. This will shrink the race for easier removal.

8. Remove the tapered roller bearing inner race from the shaft (bearing supports rear of pinion). This bearing is a slip fit and should be removed easily.

9. Remove the internal snap ring at the front of the clutch housing and remove the clutch backing plate.

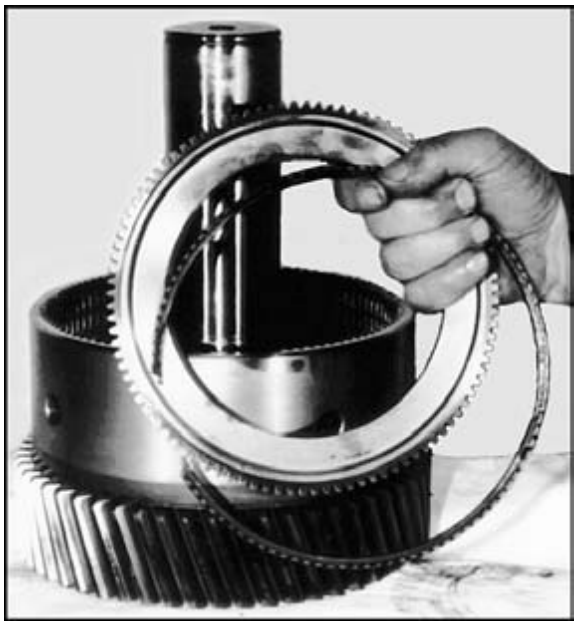


Figure 40. Backing Plate and Snap Ring

10. Remove the clutch plates (13 friction and 12 steel plates), maintaining the respective order for inspection purposes.

11. Place the clutch and shaft assembly in a press with the input side up. Using special tool T-18050-694, compress the clutch release springs and remove the retaining ring. Slowly release the pressure on the press and remove the shaft from the press. Remove special tool T-18050-694 and the spring retainer. Remove the clutch release springs from the pockets in the face of the piston. Carefully apply compressed air to the hydraulic pressure port to force the piston from the piston bore. Remove the clutch-apply piston.

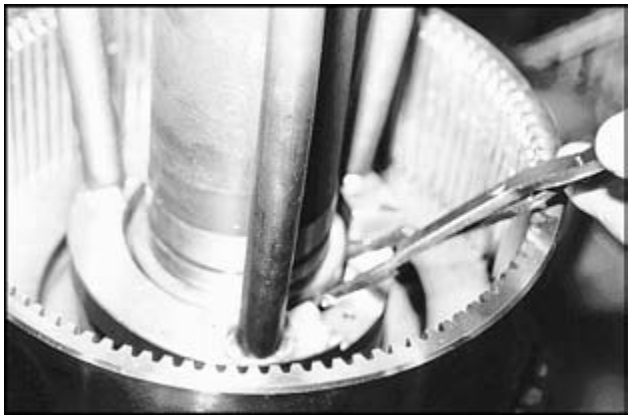
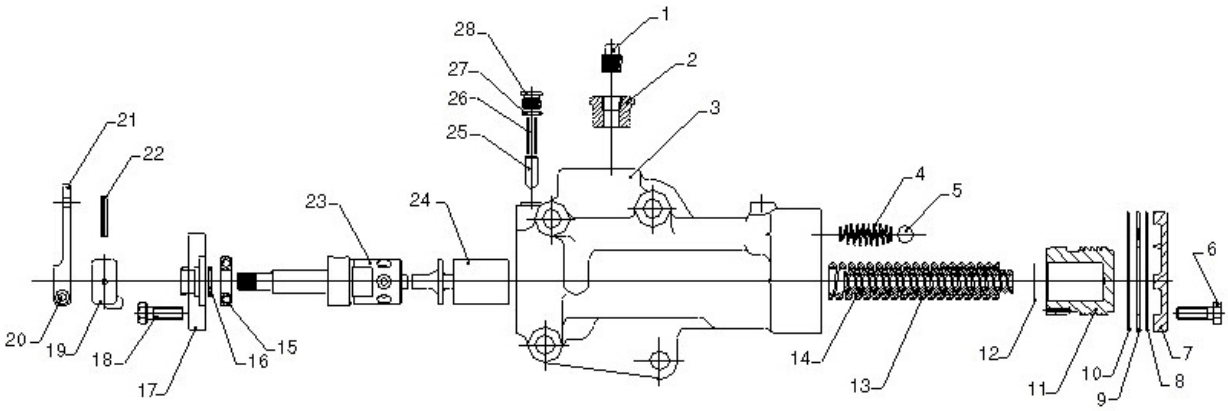


Figure 41. Remove Snap Ring (left) and Remove Piston (right)

12. Remove the the piston ring from the groove in the shaft (seals I.D. of clutch piston) and the piston ring from the groove in the O.D. of the clutch piston.

13. Do not separate the clutch housing/transfer gear from the shaft unless the shaft or the clutch housing must be replaced, and the mating part remains serviceable. To remove the clutch housing, place the shaft and clutch assembly on a press with the front end of the shaft down. Place a sleeve with an I.D. only slightly larger than the O.D. of the shaft over the input (front) end of shaft. Rest one end of the sleeve on a heavy wood block while the other end supports the inner face of the clutch housing. Apply a press force to the rear end of the shaft to separate the shaft from the clutch housing. The shaft must be protected and restrained to prevent damage from falling as the joint separates.

Selector Valve Assembly -- Mechanical Valve



1	Plug	11	Rate of Rise Piston	21	Lever
2	Bushing	12	Shim	22	Pin
3	Valve Body	13	Outer Spring	23	Valve Stem
4	Spring	14	Inner Spring	24	Piston
5	Check Ball	15	Bearing	25	Detent
6	Capscrew	16	O-Ring	26	Spring
7	Orifice Cover	17	Cover	27	O-Ring
8	Gasket	18	Capscrew	28	Plug
9	Orifice Plate	19	Collar		
10	Gasket	20	Capscrew		

Figure 42. Mechanical Selector Valve Exploded View

⚠ CAUTION

Steel ball is under pressure from the spring. Care must be taken when removing the cover and orifice plate to prevent loss of steel ball.

1. Remove four of 5/16-18 x 1.25 inch capscrews and remove the orifice cover, orifice plate, gaskets, check ball and spring.

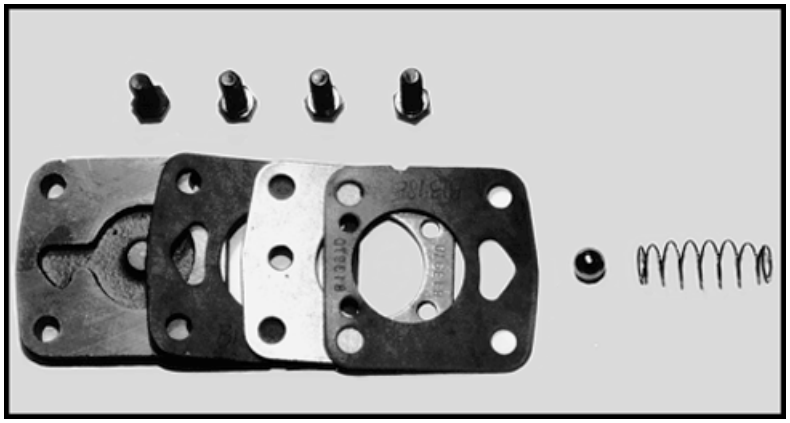


Figure 43. Cover, Gaskets, Orifice Plate, Check Ball and Spring

2. Remove the rate-of-rise piston, pressure regulating springs, and pressure regulator piston. The pressure regulator adjustment shims are in the spring pocket of the rate-of-rise piston.

3. Remove the O-ring plug, O-ring, detent spring, and detent.

4. Mark the lever and the stem to indicate the position the lever was installed on the stem. Loosen the screw clamping the shift lever to the stem and remove the lever. It may be necessary to splay the lever to be able to remove it. DO NOT apply any impact force to the lever, as the stem, lever, or bearing might get damaged.

5. Mark the stop and the stem to indicate the position the stop was installed on the stem. Drive the rollpin out of the stop with a drift punch, and remove the stop.

Figure 44. Drive Roll Pin Out of Stop

6. Remove the valve cover and valve stem.

7. Slide the valve stem out of the valve cover.

8. Remove the gasket and O-ring from the valve cover.

9. Remove the bearing from the valve stem.

Selector Valve Assembly -- Electric Valve

⚠ CAUTION

Steel ball is under pressure from the spring. Care must be taken when removing the cover and orifice plate to prevent loss of steel ball.

1. Loosen and remove four of M8 x 25 socket head capscrews, and remove orifice plate cover and gasket.

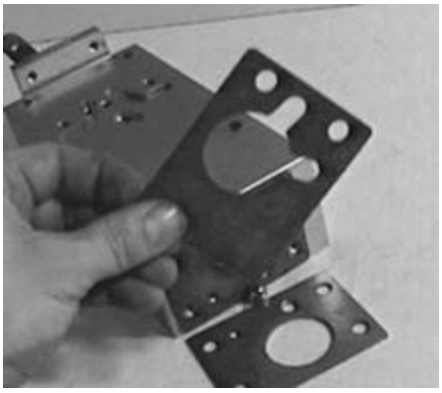


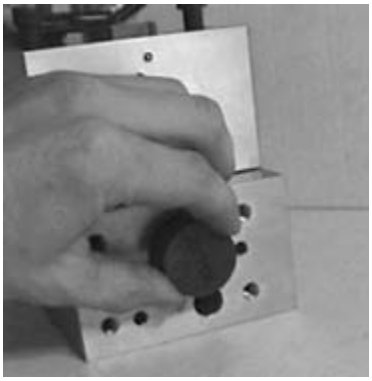
Figure 45. Orifice Plate and Gasket

2. Remove orifice plate.

3. Remove steel ball and neutral pressure regulating spring.

4. Remove orifice plate gasket.

5. Remove rate-of-rise piston. Note that shims are located between the piston and springs.



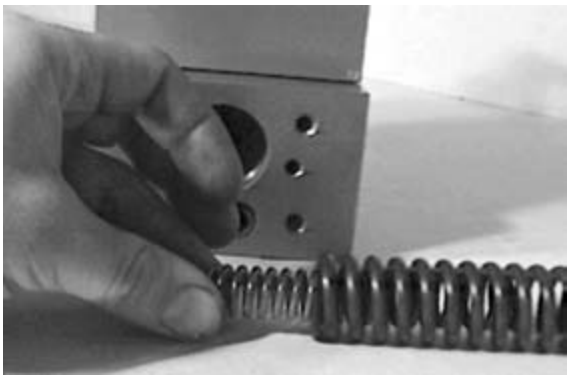


Figure 46. Rate of Rise Piston (left) and Regulator Springs (right)

6. Remove pressure regulating springs.

7. Remove pressure regulating piston with an external retaining ring pliers.

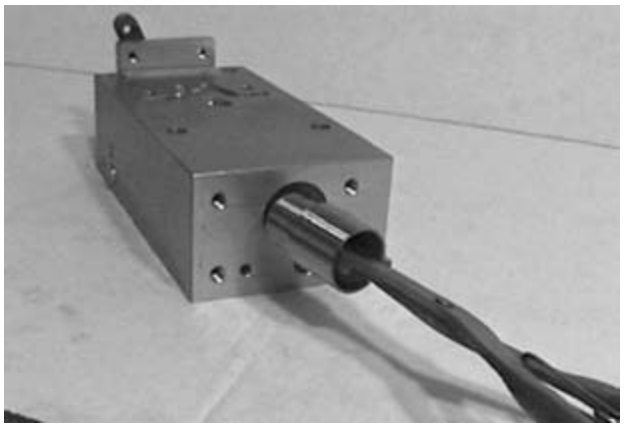


Figure 47. Removing Regulating Piston with Pliers

8. Remove external retaining ring from the lever end of the stem.

9. Loosen the clamping nut and remove the control lever from the stem. It may be necessary to splay the lever to be able to remove it. DO NOT apply any impact force to the lever, as the stem or dog-point setscrew might get damaged.

10. Remove the washer and spring from the stem.

11. Remove four of M8 x 25 socket head capscrews.

12. Remove the cover assembly with gasket from the valve body.

13. Remove the O-ring and oil seal from the cover assembly.

Figure 48. O-ring in Cover

14. Remove the two electrical switches from the sides of the valve body and the two steel balls from each of the switch bores in the valve body.

15. Remove the detent setscrew, spring, and steel ball from the valve body.

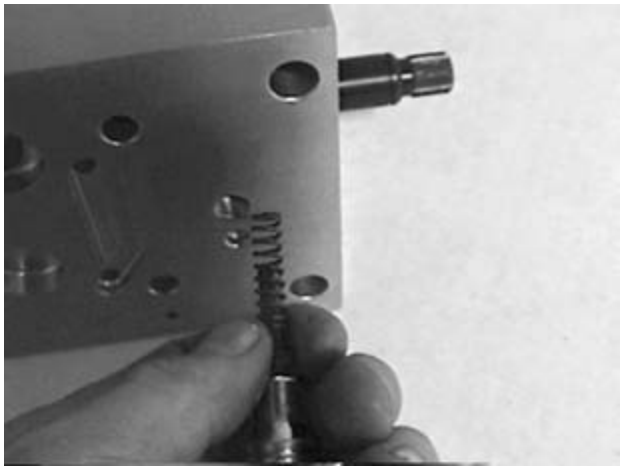


Figure 49. Detent Setscrew and Spring

16. Remove the dog-point setscrew. Note that the setscrew is retained with MA908 threadlocker.

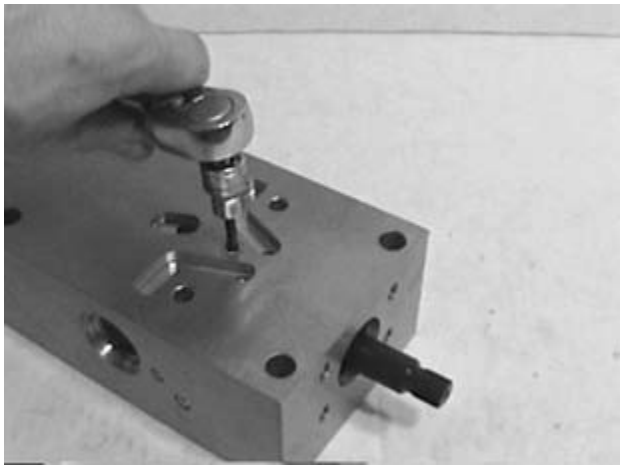


Figure 50. Dogpoint Setscrew

17. Remove the stem from the valve body partially.

18. Remove the thrust washer from the stem.

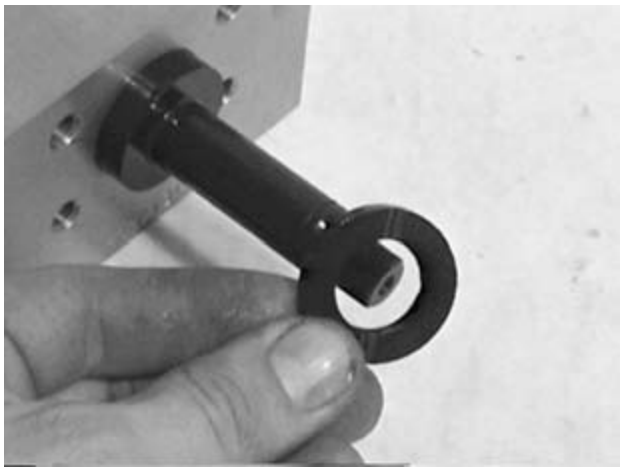


Figure 51. Thrustwasher

19. Remove the stem from the valve body.

20. Remove the roll pin (retains the shuttle ball seat) with a needle-nose pliers.

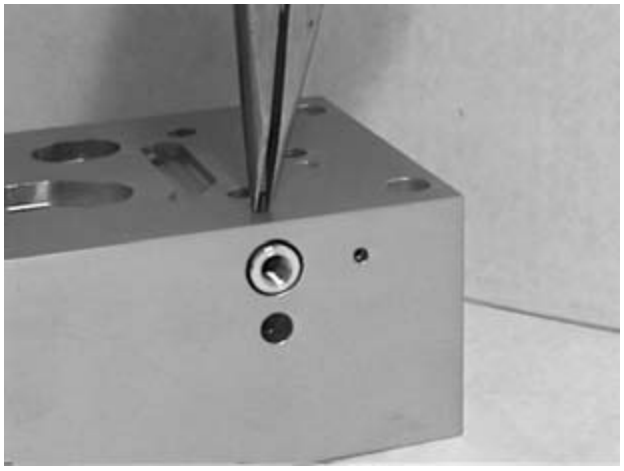


Figure 52. Roll Pin Retaining Shuttle Seat

21. Thread a M8x1.25 screw (one of the cover screws works well) into the seat and remove it from the valve body.

22. Remove the shuttle ball from the valve body.

Disassembly of Upper Valve Body Half (electric section)

1. Remove the Weatherpak connector from the valve body by sliding it in the direction of the opening in the shroud.

2. Mark the wires with the location letters that are on the Weatherpak connector. Open the end of the Weatherpak connector to allow removal of the pins and wires.

3. Remove the pins (for the wires of all but one solenoid) from the Weatherpak connector using the extraction tool. Tool is Packard Electric P/N 12014012.

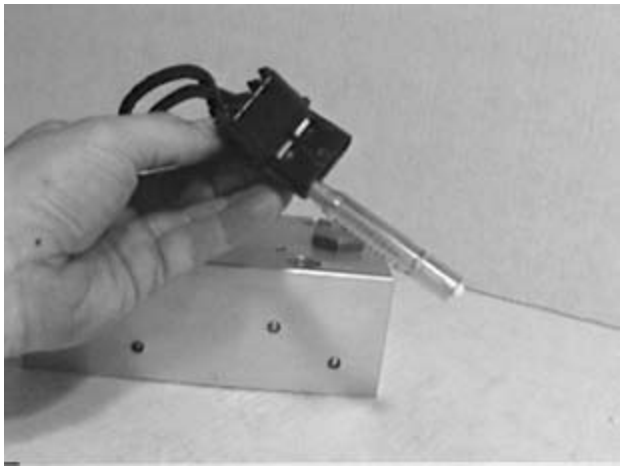


Figure 53. Remove Wires using Extraction Tool

4. Mark the two solenoids for location identification and remove them.

5. Remove the plug (No hydraulic lock on MG5600).

6. Remove the filter screen from the valve body.

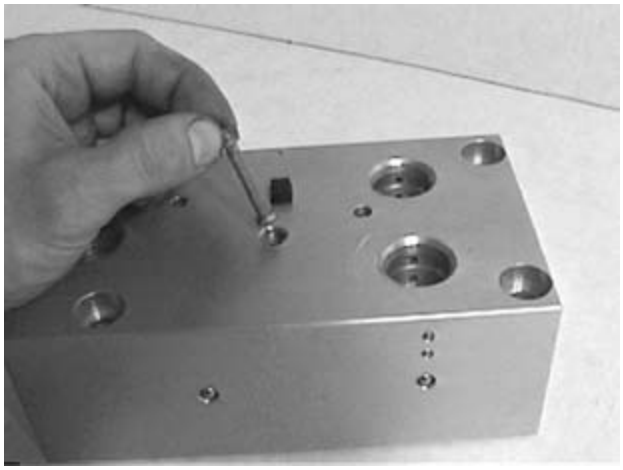


Figure 54. Remove Filter Screen using Allen Wrench

7. Remove the two socket head O-ring plugs from the bores in the end of the valve body.

8. Remove the two spools from the valve body.

9. Remove the spool return spring and dowel pin from the bottom of each of the spool bores in the valve body.

Cleaning and Inspection

Cleaning

Note: Replace all oil seals, gaskets, O-rings piston rings, seal rings, snap rings, etc., as a part of any maintenance or overhaul procedure. Replace shims that are damaged or destroyed in disassembly.

- ❑ Clean all parts using EPA/OSHA approved solvents or by steam cleaning. Parts must he dried and oiled immediately.
- ❑ Examine all parts carefully for grit, dirt and abrasives and reclean them if necessary.
- ❑ Clean all oil passages by working a piece of wire back and forth through the passages and then flushing them with cleaning solvent.
- ❑ Use clean solvent to flush oil pumps, valves, etc.
- ❑ Flush all hoses, tubing, coolers etc., particularly if the unit is being disassembled because of an internal failure.
- ❑ De-burr the housing and bearing carrier with a stone or file in the vicinity of all pusher screw locations.

Cleaning Bearings

Do not remove grease in which new bearings are packed. Thoroughly wash bearings that have been in service. Soak bearings in solvent if they are particularly dirty or filled with hardened grease.

⚠ CAUTION

Never dry bearings with compressed air. Do not spin unlubricated bearings. Oil bearings with SAE 10 engine oil immediately after cleaning. Oil bearings before inspection.

Preventing Dirt from Entering into Bearings

Dirt and grit in bearings are often responsible for bearing failure; consequently, it is important to keep bearings clean. Do not remove grease from new bearings. Keep the wrapper on new bearings until they are installed. Do not expose clean bearings if they are not to be assembled at once. Wrap them with a clean lint-free cloth or paper to keep out dust.

Previously Sealed Joints

- ❑ For previously sealed joints, scrape surfaces to remove old gasket material or silicone.
- ❑ Clean surfaces with solvent to remove oil and grease residue.
- ❑ Test for clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface in a film. If the water puddles or forms beads, use fresh solvent and reclean.

Inspection

Housings, Cast Parts, and Machined Surfaces

- ❑ Replace cast parts or housings that are cracked.
- ❑ Inspect bores for wear, grooves, scratches and dirt. Remove burrs and scratches with crocus cloth or soft stone. Replace deeply grooved or scratched parts. Do not remove excess material by sanding. This will cause loss of press of bearings or races.
- ❑ Inspect oil passages for obstructions. If you find an obstruction, remove it with compressed air or work a wire back and forth through the passage and flush it with solvent.
- ❑ Inspect machined surfaces for burrs, scratches, nicks and foreign matter. If you cannot remove the defect with crocus cloth or a soft stone, replace the part.
- ❑ Inspect threaded openings for damaged threads. Chase damaged threads with a tap of the correct size.
- ❑ Inspect studs for damaged threads and looseness. Replace defective studs.
- ❑ Inspect dowel pins for wear or damage. Replace defective dowels. This applies where a matched set of parts is not involved.
- ❑ Inspect dowel pin holes for wear due to movement between mating parts. If a dowel pin hole is worn, re-bore and sleeve the hole when possible. Otherwise, replace the parts. This applies where a matched set of parts is not involved.

Valve Seats

Inspect valve seats for burrs, nicks and scratches. If you cannot remove these defects with a crocus cloth, replace the part. Check to see that the valve is seating properly after reworking the valve seat.

Bearings

- ❑ Inspect bearings for roughness of rotation. Replace the bearing if the rotation is rough.
- ❑ Inspect bearings for corrosion, and for indication of wear of balls or rollers. Inspect for scored, scratched, cracked, pitted or chipped races. If you find one of these defects, replace the bearing.
- ❑ Inspect bearing bores and shafts for grooved, burred, or galled conditions that would indicate the bearing has been turning in its housing or on its shaft. If you cannot repair the damage with a crocus cloth, replace the part.

Bushings and Sleeves

Inspect bushings for size and out-of-roundness. Inspect for scores, burrs, sharp edges, and evidence of overheating. Remove scores with a crocus cloth. If the bushing is out-of-round, deeply scored, or excessively worn, replace it.

Thrust Washers and Spacers

Inspect thrust washers for distortion, scores, burrs and wear. Rework or replace any defective thrust washers or spacers.

Gears

- ❑ Inspect gears for scuffed, nicked, burred or broken teeth. If you cannot remove the defect with a soft stone, replace the gear.
- ❑ Inspect gear teeth for wear that may have destroyed the original tooth shape. If you find this condition, replace the gear.
- ❑ Inspect thrust faces of gears for scores, scratches and burrs. If you cannot remove these defects with a soft stone, replace the gear.

Splined Parts

Inspect splined parts for stripped, twisted, chipped or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found.

Springs

Inspect springs for broken or distorted coils. Replace the spring if either of these defects is found.

Flexible Hoses

Inspect all flexible hoses for cracks and sponginess. Replace damaged hoses.

Clutch Plates

Inspect clutch plates for signs of overheating, pitting, or excessive wear of the friction and splined surfaces. Replace the clutch plates if one of these defects is found. Refer to wear limits in Description and Specifications.

Assembly

The MG5600 series transmission requires the use of a SKE THAP 300 Oil Injection Kit (See Special Tools) or similar device to install the output flange and output shaft.

Unless otherwise specified, all torque values listed are for capscrews that have been lubricated on the threads and contact surfaces.

The following discussion contains frequent reference to the transmissions parts and components. Refer to Engineering Drawings.

Prior to Assembly

Use the following reference: The input side of the transmission is the front and the output side is the rear. Left and right sides are determined by facing the output side of the transmission from the rear.

Identify and place the following bearing components in an oven at 250˚F (120˚C) for 30 minutes: Front output bearing inner race, both rear output bearing cones, both rear clutch shaft bearing cones, and all bearing cones for the input reduction gears of the MG-5600DR.

Submerge all new friction clutch plates in transmission oil for a minimum of one hour prior to installation.

Identify and place the following bearing components in a deep freeze for at least two hours prior to assembly: Front output bearing roller and outer race assembly, both rear output bearing cups, both rear pinion bearing cups, both front pinion bearing cups, both pinion inner needle bearings, and rear cups for the input reduction gears of the MG-5600DR.

Preliminary Assembly

1. Lay the transmission on blocking with the rear side up

2. Install the chilled cups for the primary and secondary front tapered roller bearings into their respective bores in the front inner face of the housing. Use driver T-18050-686 to press/drive cups to the bottom of the bore. It is important to maintain downward force as temperatures equalize to insure that cup is at bottom of bore.

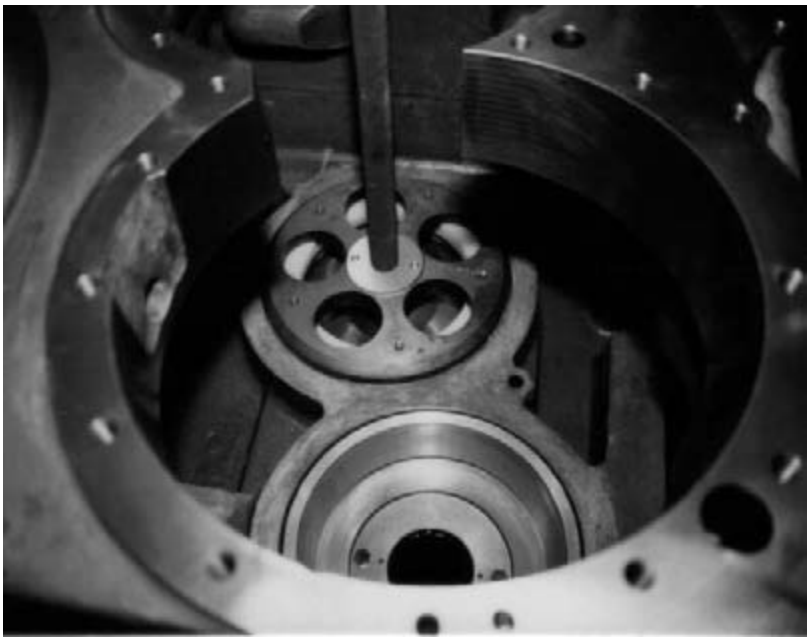


Figure 55. Front pinion bearing cup installation

3. Install the chilled output shaft front roller bearing into its bore in the front inner face of the housing. Use driver T-18050-684 to press/drive the bearing to the bottom of its bore. Install the output bearing retainer ring into the output-bearing bore.

Figure 56. Front output bearing installation

4. Install the chilled front inner output-bearing cup into the transmission housing. Use tool T-18050-685 to seat the cup in the housing.

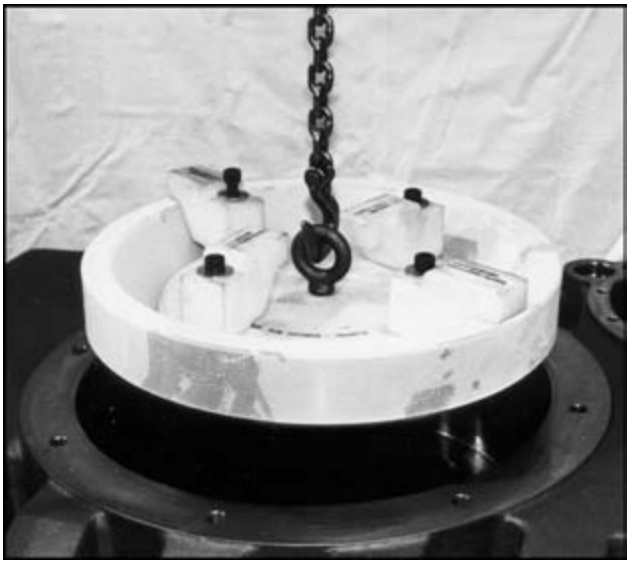


Figure 57. Inner output bearing cup installation

5. Install the input shaft plate into the housing and secure with capscrews. See below. Apply proper sealant, and torque non lubricated capscrews to 80 Nm (59 lb-ft).

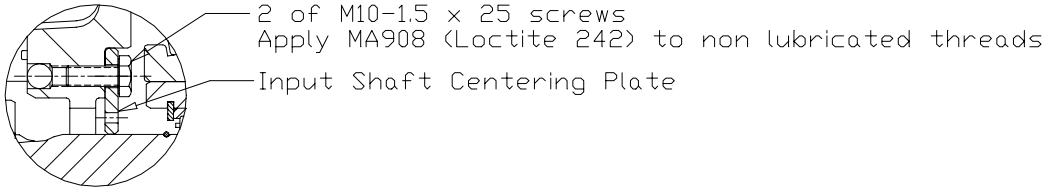


Figure 58. Input Shaft Centering Plate

Output Shaft and Gear Assembly

1. Block the housing in the upright position.

2. Clean the tapered surface of the output shaft and the tapered bore of the output gear. Use an OSHA approved cleaning solvent to remove all traces of dirt, grease, oil, etc. Loctite 7070 cleaner is recommended.

3. Check the clearance (advance) between the output shaft and the output gear outside of the transmission. The calculated advance C-(A+B) should be 11.86 mm (0.467 in.) to 13.54 mm (0.533 in.). See Figure 59 and 60.

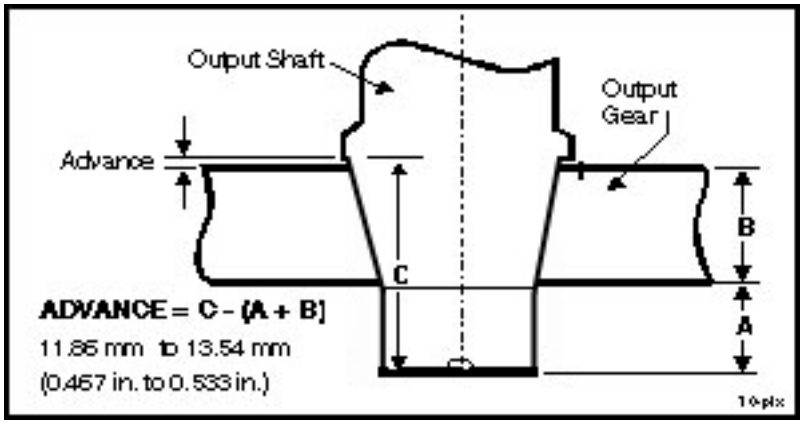


Figure 59. Advance Calculation Method

Figure 60. Note Gap Between Shoulder and Gear

Should the calculated advance fall outside the range given, check to assure that all measurements and calculations are correct. If no errors are found and the expected advance is out of tolerance, it will be necessary to change parts. Contact the Product Service Department at Twin Disc, Incorporated for assistance.

⚠ CAUTION

The tapered surface of the shaft and the matching tapered bore of the gear must be completely free of grease, oil, dirt or solvent residue. Failure to properly clean the mating parts could prevent the proper advance of the gear on the shaft and adversely effect the torque carrying capacity of the assembled joint.

4. Coat the tapered surfaces of the output shaft and gear with thin oil.

5. Install tools T-20023-1 and T-19987 onto the output gear.

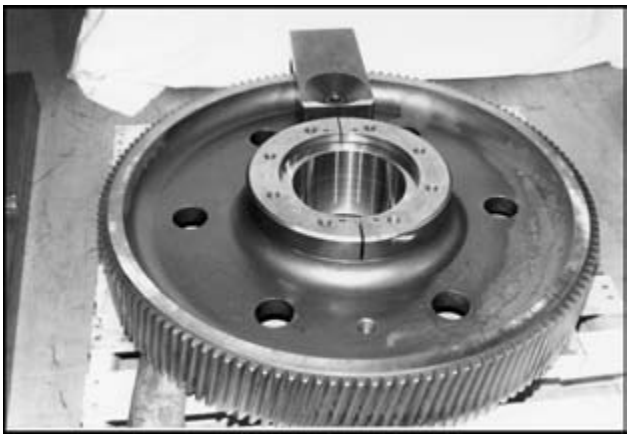


Figure 61. Tool T-20023-1 (Collar) and T-19987 lift adapter

6. Use special tool T-19987 to lift the output gear and lower into the transmission housing.

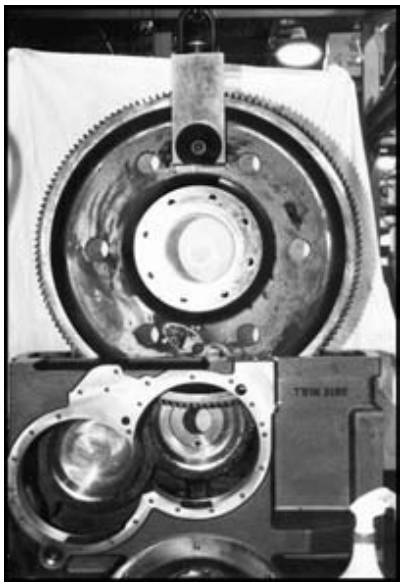


Figure 62. Lowering Gear Into Housing

7. Use the shaft locator tools T-19987 (Details 4 through 6) to position and hold the output gear in the housing.

Figure 63. Aligning shaft (T-19987 detail 4) left and Aligning plate (T-19987 Detail 5) right

8. Place and block the transmission housing with the output side facing up. Block in a manner that the input shaft will have clearance when it is installed, and such that the four holes near the output shaft in the front of the housing are accessible for the installation of capscrews. Remove output shaft alignment tools T-19987.

9. Install the heated output bearing inner race onto the front of the output shaft with special tool T-18050-687 and install the bearing retainer snap ring onto the output shaft.

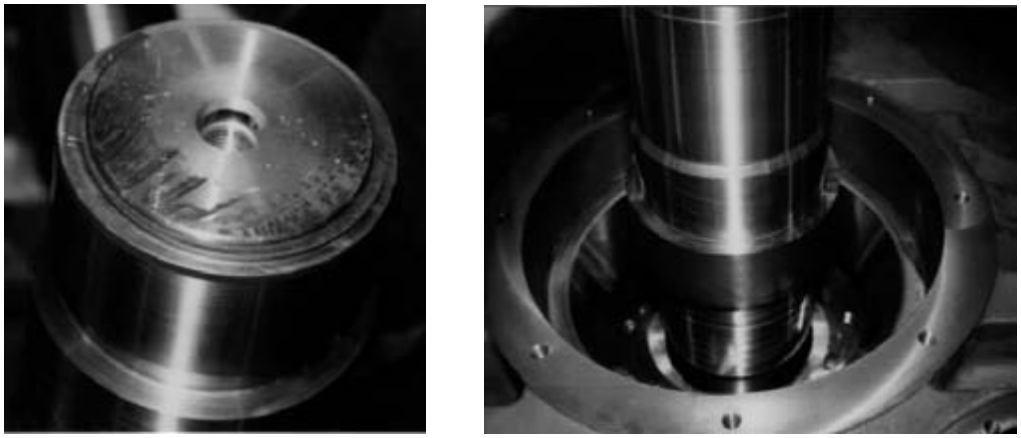


Figure 64. Bearing Inner Race (left) and Lower Shaft Into Gear (left)

10. Lower the output shaft into the output gear in the transmission housing. Seat the shaft onto the taper of the gear using only the weight of the shaft.

11. Connect the oil injector to the output shaft.

12. Install fixture T-20023 (Details 2 through 20) onto the output gear and shaft.

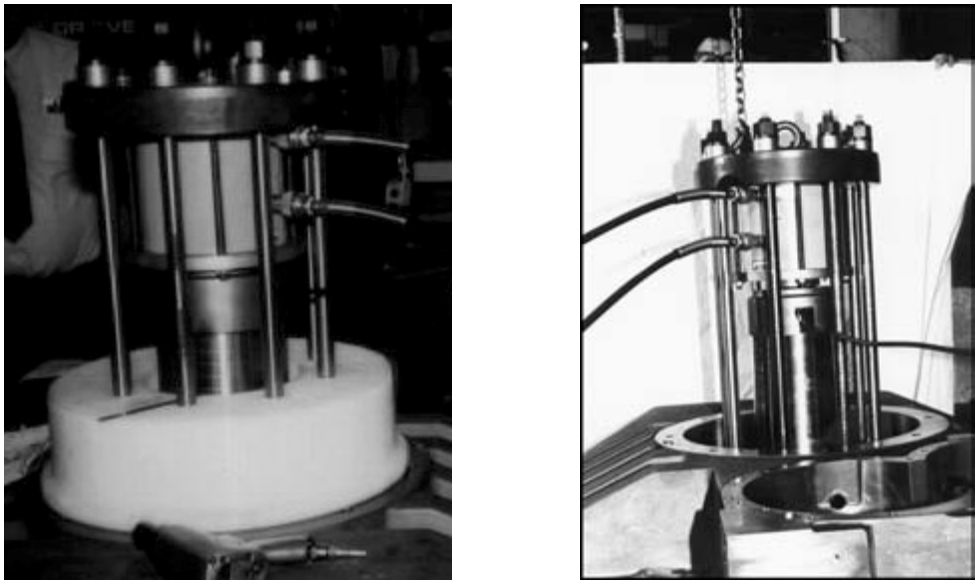


Figure 65. Fixtures in Place and Injection Lines in Place

13. Inject oil with a viscosity of 300 mm^2/S (300 cSt) at room temperature into the shaft until it leaks out of both ends of the mating surfaces.

14. Advance the output gear to the shaft shoulder stop using a 100 ton (889.6 kN) ram load.

15. Release the injection oil pressure between the mating surfaces and wait five minutes before releasing the pull-on force.

16. Remove the assembly tools from the output shaft and gear.

17. Determine and record the actual advance by measuring any gap between shaft shoulder and gear face.

18. Install the front bearing cone assemblies for the primary and secondary clutch shafts.

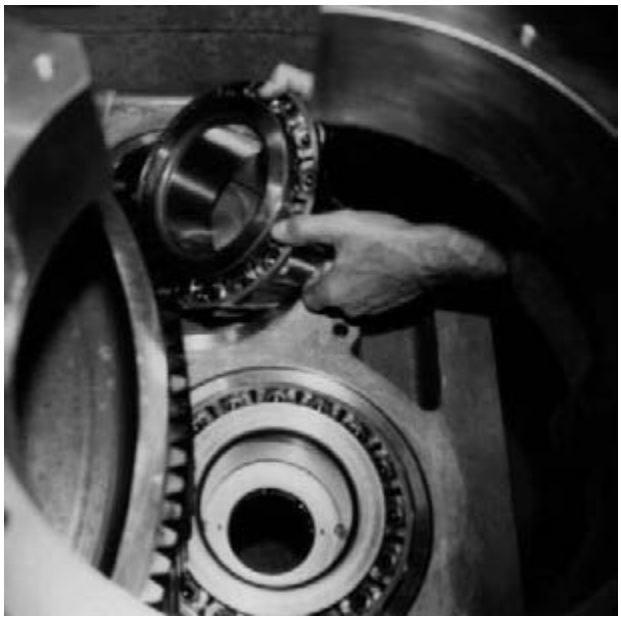


Figure 66. Raise Output Shaft and Gear if Necessary to Install Bearing Cones

Rear Output Shaft Bearing

1. Install the heated inside rear output shaft tapered roller bearing cone onto the output shaft with the small O.D. of bearing to the front.

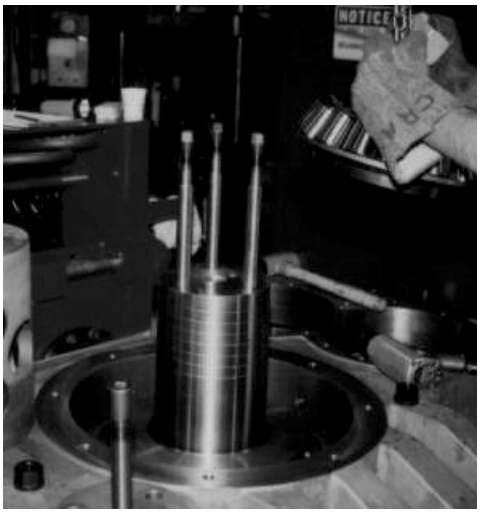


Figure 67. Install Forward Rear Bearing Cone (left) and Install Rear Bearing Cone (right)

2. Install the heated outside rear tapered roller bearing cone onto the output shaft with the small O.D. to the rear.

3. Using special tool T-18050-688, press and retain the bearings against the shaft shoulder.

Figure 68. Clamp Bearings until Cool (left) and Install Cup Into Retainer (right)

4. After the bearing cools remove tool T-18050-688.

5. Install chilled outside rear bearing cup into output seal carrier, using special tool T-18050-689.

6. Install the gear pan assembly into the housing and over the gear. Rotate gear to aid in aligning holes. Install four capscrews (M10-1.5 x 45) and sealing washers. Torque the capscrews to 64 Nm (47 lb-ft).

Output Shaft Tapered Roller Bearing Adjustment

1. Install the seal carrier without the o-ring. Secure the seal carrier with eight capscrews (M16-2.00 x 45), torqued evenly to 10 Nm (7 lb-ft). Use a taper gauge or feeler gauge to measure the gap between the rear housing face and the flange of the output seal carrier. Build a trial shim pack with a thickness equal to the gap plus 0.50 mm (0.020 in). Install the shim pack, and torque the eight capscrews to 275 Nm (203 lb-ft).

Figure 69. Lower Cover Over Output Shaft (left) and Measure Gap for Shims (right)

2. Seat the front tapered roller bearing by rotating the shaft several times.

3. Install a dial indicator onto the housing with the finger resting on the rear of the output shaft or on the lifting fixture. Zero the dial indicator and mark the spot where the reading was taken.

4. To lift the output shaft, install eyebolts and strap to the rear of the output shaft. Using a hoist, apply a lifting force of 1340 N to 4000 N (300 lbs to 900 lbs) greater than the weight of the shaft and gear assembly. Rotate the shaft several times with the lifting force applied. Stop the shaft rotation with dial indicator finger on the original mark, and read the shaft endplay on the dial indicator.

Figure 70. Read Endplay with Indicator Finger on Mark

5. Adjust the shim pack thickness from step 1 above to obtain an endplay of 0.05 mm to 0.15 mm (0.002 in to 0.006 in). Install the new shim pack between the seal carrier and the housing.

6. Repeat steps 2 through 5 until the endplay is between 0.05 mm to 0.15 mm (0.002 in to 0.006 in).

7. Remove the lifting fixture. Remove the capscrews and remove the output seal carrier.

8. Install the o-ring in the groove in the O.D. of the output seal carrier pilot.

9. Coat the O.D. of the oil seals with M2828 anaerobic sealant, and install the oil seals into the output seal carrier, using driver T-18050-692. Remove any excess sealant that is wiped off as the seals are pressed into position. Install the forward seal (seal closest to bearing cup) with the open lip toward the inside of the transmission, and install it flush with the inner face of the seal carrier. Install the rear seal with open lip of the seal toward the rear of the transmission, and install it flush with outer (rear) face of the seal carrier.

10. Pack the area between the seals with water pump grease.

Figure 71. Fill Cavity between Seals with Grease

11. Install the grease fitting (zerk fitting) if not previously installed.

12. Install the final shim pack established above.

13. Install the assembled output seal carrier, and secure with the eight capscrews (M16-2.00 x 45), torqued to 275 Nm (203 lb-ft).

Assembly and Installation of the Primary and Secondary Shafts

The procedure is the same for both clutch shafts unless otherwise noted.

1. Clean the tapered surface of the clutch shaft and the tapered bore of the transfer gear. Use an OSHA approved cleaning solvent to remove all traces of dirt, grease, oil, etc. Loctite 7070 cleaner is recommended. Wipe dry with clean paper towels. Do not touch the cleaned tapers.

2. Determine if the secondary shaft and transfer gear can be advanced properly. Support the clutch shaft in a vertical position standing on its front end. Use a depth micrometer and measure the distance from the rear end of the shaft to the shaft shoulder at the small end of the taper. Record this distance as dimension “A”. Install the transfer gear on the clutch shaft taper, with the small diameter of tapered bore up. Seat the gear on the shaft taper with 445 N to 890 N (100 lbs to 200 lbs) of force. Use a depth micrometer to measure the distance from the rear end of the shaft to the machined face of the transfer gear at the small diameter of the tapered bore. Record this distance as dimension “B”. Calculate the expected advance equal to A - B. The calculated advance must be 3.33 mm to 4.29 mm (0.131 in to 0.169 in). If the calculated advance is not within the specified range, recheck all measurements and calculations for errors. If no errors are found, contact the Product Service Department at Twin Disc, Incorporated for assistance.

3. Move the shaft and transfer gear to a press with at least 445 kN (100 tons) capacity. Install special tool over the shaft, and center the gear and shaft under the ram of the press, and apply approximately 569 kN to 890 kN (64 tons to 83 tons) of force on the special tool.

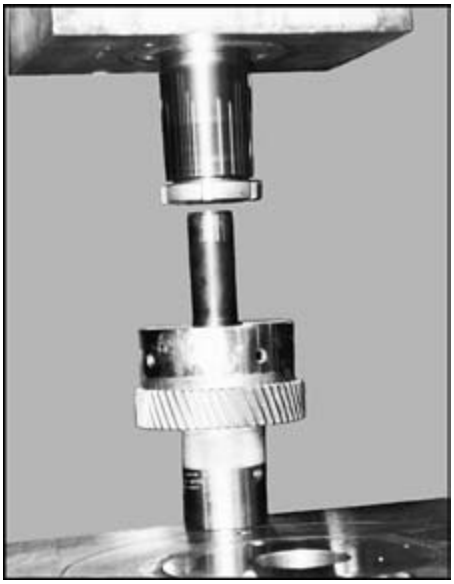


Figure 72. Pressing Shaft Into Gear

4. Remove the special tool, and measure the distance from rear end of shaft to the face of transfer gear using a depth micrometer (record as “B”). Actual advance (A - B) should be 3.33 mm to 4.29 mm (0.131 in to 0.169 in). If the transfer gear has not been advanced as specified above, contact the Product Service Department at Twin Disc, Incorporated for information and assistance. The transfer gear face should be within 0.05 mm (.002 in) of the shaft shoulder at the small diameter end of the taper.

5. Install the heated tapered roller bearing cone assembly over the shaft, or use special tool driver T-18050-681 and an hydraulic press to press the rear tapered roller bearing cone onto the clutch shaft. Install the bearing with the large O.D. toward the transfer gear and press the bearing to seat against the transfer gear. Install the retaining snap ring with the tapered side of the snap ring away from the bearing.

Figure 73. Pressing Bearing Onto Shaft (left) and Install Retaining Snap Ring (right)

6. Install the two seal rings into the grooves on the shaft.

7. Turn the shaft over and support the assembly on the rear face of the transfer gear with clearance to avoid damage to the bearing and shaft end.

8. Install the piston seal ring in the groove in the clutch shaft to seal the I.D. of the clutch apply piston and apply a coat of light grease or oil to the piston seal ring.

9. Install the piston seal ring in the groove in the O.D. of the clutch apply piston and apply a coat of light grease or oil to the piston seal ring.

10. Install the clutch apply piston into the piston bore in the transfer gear.

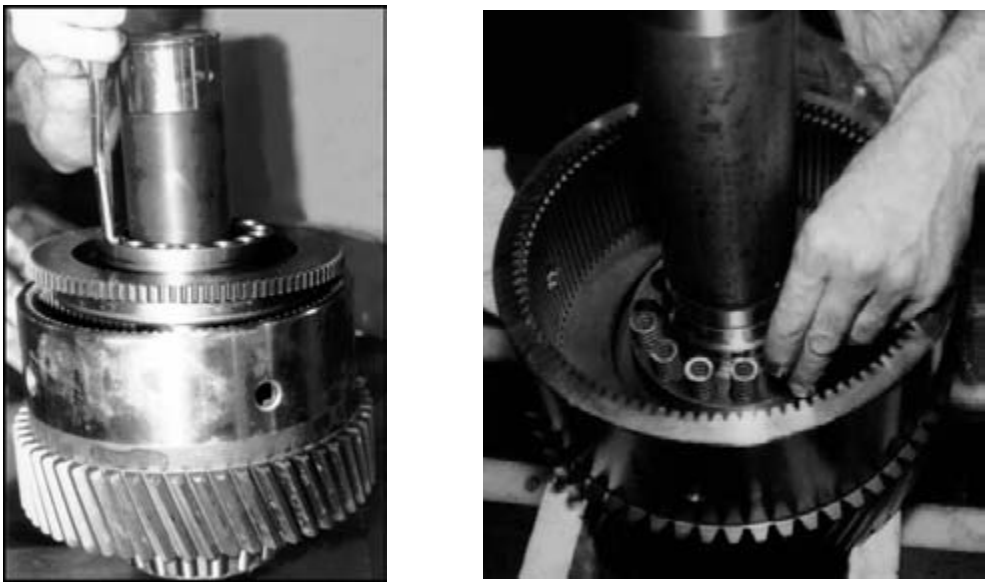


Figure 74. Install Piston Into Gear (left) and Install Springs Into Pockets (right)

11. Install 14 clutch return springs into the pockets in the face of the clutch-apply piston, and install the spring retainer over the springs with the open end toward the springs. Working through the holes in the retainer, use a small punch or probe to assure that all the springs are in the pockets in the face of the piston and that the springs stand straight.

12. Place the external snap ring on the shaft. and move the shaft assembly to a press and install special tool T-18050-694 over the shaft. Compress the spring retainer and springs to expose the snap ring groove in the shaft. Install the snap ring into the exposed groove on shaft. Slowly release the pressure on the springs assuring that the spring retainer counterbore covers the snap ring and prevents the snap ring from coming out of the groove. Remove special tool T-18050-694.

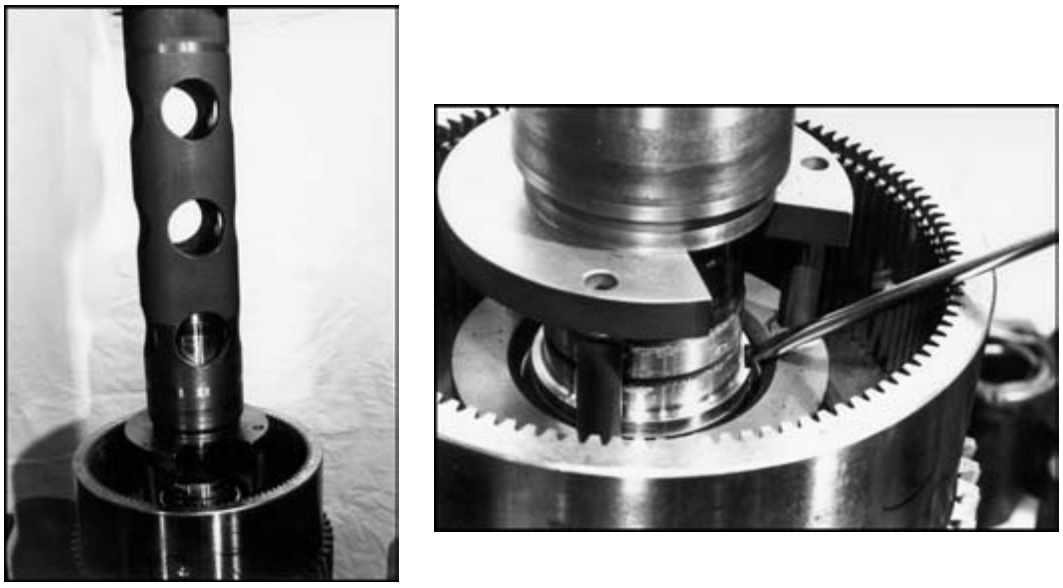


Figure 75. Compress Spring Retainer and Springs (left) and Insert Snap Ring Into Groove (right)

12. Beginning with a friction plate, alternately install 13 oil soaked friction plates and 12 steel plates into the clutch drum and against the clutch apply piston.

13. Install the clutch backplate and internal snap ring.

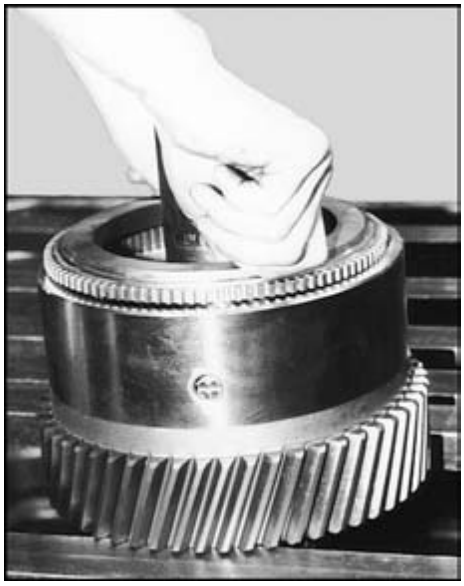


Figure 76. Alternately Install Clutch Plates (left) and Install Backing Plate (right)

14. Install the pinion tapered roller bearing cone assembly onto the clutch shaft. Install with the large diameter of the bearing seating against the shoulder on the shaft. This bearing is a slip fit and will not require special tools for installation.

15. Use special tool driver T-18050-691 and install the chilled cup for the tapered roller bearing into rear of the clutch shaft pinion, as seen below. The bearing cup is installed with the small I.D. of the taper toward the front and seated against the shoulder of the bore in the clutch hub.

Figure 77. Install Bearing Cup

16. Install the chilled needle roller bearing into the bore at the front of the pinion, and install the internal snap ring into the groove in the pinion bore.

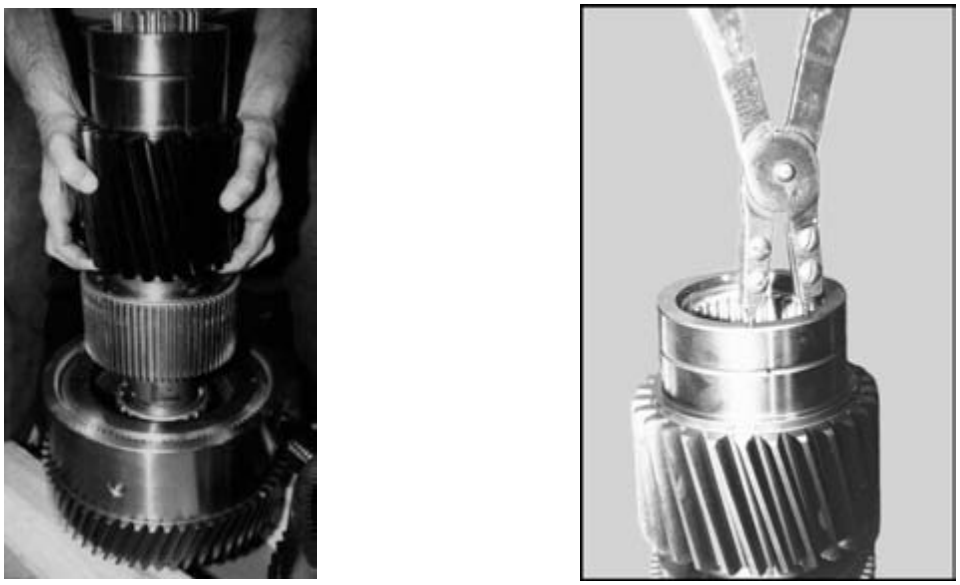


Figure 78. Lower Pinion Assembly (left) and Install Bearing Retaining Snap Ring (right)

17. Install the pinion into the clutch drum. Rotate in both directions to engage the clutch plate teeth onto the clutch hub. A slight lifting effort while rotating may make the alignment and subsequent engagement easier. Continue until all plate teeth are in mesh, and the pinion is riding on the tapered roller bearing. Install the external snap ring to insure that the pinion cannot accidentally slide off of the shaft.

Figure 79. Rotate while Lifting to Engage Teeth (left) and Install Snap Ring to Retain Pinion (right)

18. Repeat the assembly procedure for remaining clutch shaft assembly.

19. If not already done, install the front tapered roller bearing cones for the primary and secondary pinions onto the cup previously installed in the bearing bores in the front of the transmission housing inner wall.

Note: The front tapered roller bearing cones in assembly 1015239, with a reduction ratio of 6.04:1. has a spacer between the pinion gear teeth and the rear of the bearing cone on both clutch shafts.

20. If equipped with a bearing spacer, lay the bearing spacer on top of tapered roller bearings installed above. Position the spacer with the chamfer on the O.D. of the spacer facing up. Use grease to hold the spacer in position as the primary and secondary shafts are installed.

21. Install the primary and secondary shaft assemblies into the main transmission housing using tool T-18050-726.

Figure 80. Lower Clutch Shafts Into Housing

Installation of the Bearing Carrier and Manifold

1. Install the bearing carrier gasket over the dowels onto the rear of face of the housing. Install with the silicone bead up. No additional sealant should be used.

   Note: The rear bearing cups are a slip fit into the bore of the bearing retainer. The rear bearing cup retaining method is different for the MG-5600 and the MG-5600DR models, and the lube relief valve arrangement is also different between the two models.

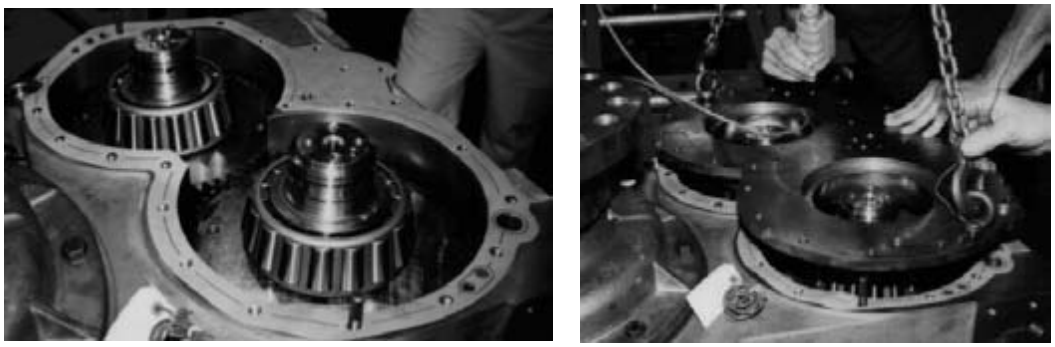


Figure 81. Gasket with Silicone Bead-up (left) and Lower Assembled Bearing Carrier (right)

Model MG-5600

2. Assemble the lube relief valve spring and lube relief valve steel ball into the lube relief valve housing. Attach the assembled lube relief valve on to the inner face of bearing carrier with two capscrews (M8-1.25 x 16) and washers. Torque the capscrews to 33 Nm (24 lb-ft.)

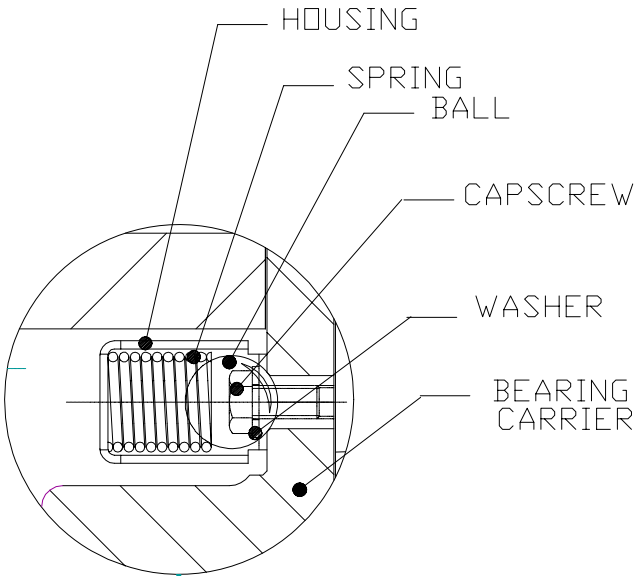


Figure 82. MG-5600 Lube Relief Valve

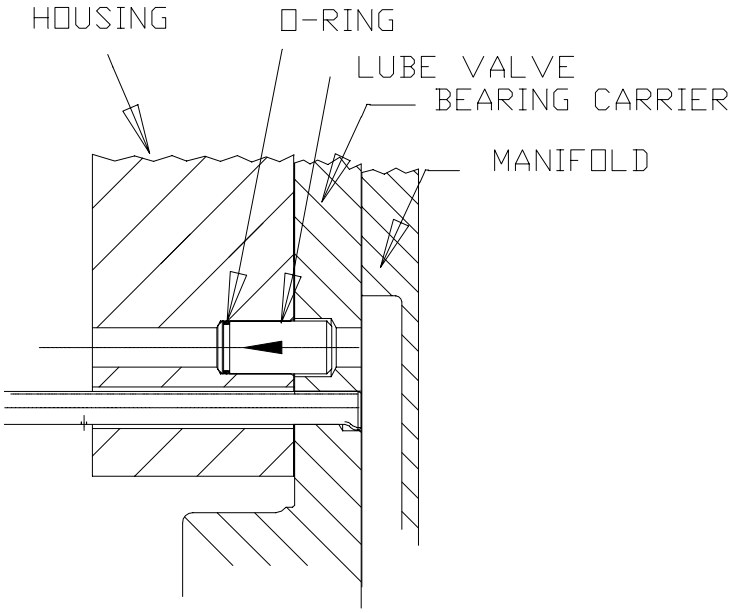


Figure 83. MG-5600DR Lube Relief Valve

3. Install two guide studs into the face of the housing. Install the bearing carrier over the studs and onto the dowels in the housing face. Use a soft hammer to seat the carrier if necessary.

4. Install the lubrication tube through the “keyed” hole in the bearing carrier. The tube fits into a machined pocket in the front inner face of the housing. Turn the tube so the elongated “key” of the tube fits into the corresponding “key” in the bearing carrier. The properly installed the lubrication tube should be flush with the rear face of the bearing carrier.

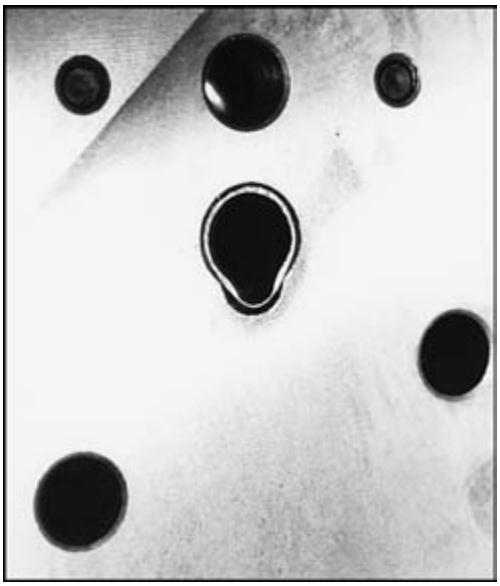


Figure 84. “Keyed” Lube Tube Installed Flush with Housing

5. Install the cups for the rear-tapered roller bearings on the primary and secondary shafts into the bores in the bearing carrier. Tap the cups down to seat on the bearing cones with a soft hammer or brass bar.

6. Install the manifold gasket over the guide studs and against the bearing carrier. Install with the silicone bead up. No additional sealant should be used.

7. Install the shim retainers next to bearing cups installed above. Align the shim retainer rollpins in a line across the center of the primary and secondary shafts.

8. Push the tapered roller bearing cups, with shim retainers, firmly against the roller bearing cones on rear of the primary and secondary shafts. Using a depth micrometer, measure the distance from the manifold gasket face to the shim retainers. The measured distance is possible shaft endplay. Use assorted shims to develop a shim pack for each shaft to reduce the shaft endplay to 0.05 mm to 0.15 mm (0.002 in to 0.006 in). Install the calculated shim packs at each shaft location.

Figure 85. Shim Retainers with Roll Pins

Model MG-5600DR

2. Install the lube relief valve assembly into the lube relief hole. Note that this hole has a step in it to retain the lube valve from falling through into the unit.

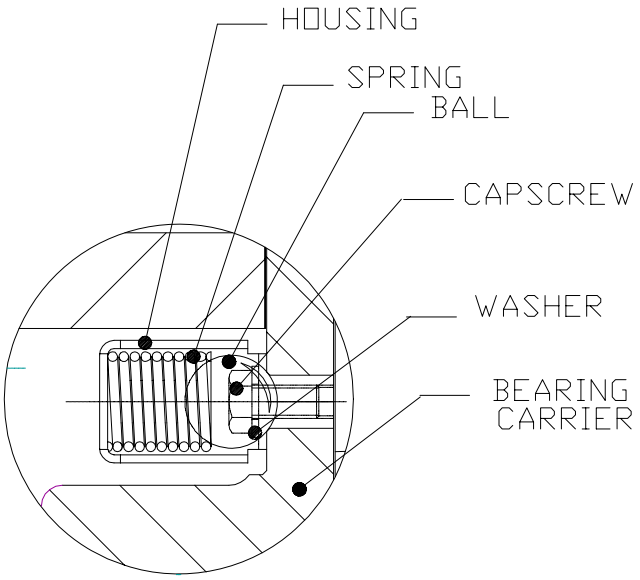


Figure 86. MG-5600 Lube Relief Valve

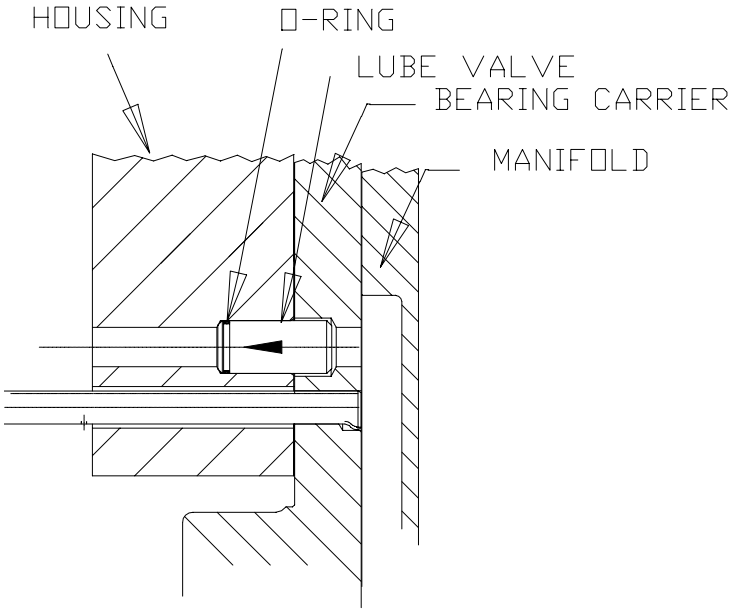


Figure 87. MG-5600DR Lube Relief Valve

3. Install several shims into each bearing bore in the bearing retainer to obtain a trial measurement. Install the cups for the rear-tapered roller bearings on the primary and secondary shafts into the bores in the bearing carrier against the shims.

4. Install two guide studs into the face of the housing. Using caution that the bearing cups do not fall out, install the bearing carrier over the studs and onto the dowels in the housing face. Use a soft hammer to seat the bearing cups against the bearing rollers if necessary. The bearing retainer should not contact the gasket if enough shims were installed for the trial measurement.

5. Use a feeler gauge, and measure the gap between the bearing carrier and the gasket. Measure in several locations and determine the maximum gap.

6. Remove the bearing carrier and bearing cups, and reduce the shim pack thickness by an amount equal to the measured gap plus 0.05 mm to 0.15 mm (0.002 in to 0.006 in). Reinstall the bearing carrier onto the transmission. There should not be a gap between the bearing carrier and the gasket.

7. Install the lubrication tube through the “keyed” hole in the bearing carrier. The tube fits into a machined pocket in the front inner face of the housing. Turn the tube so the elongated “key” of the tube fits into the corresponding “key” in the bearing carrier. The properly installed the lubrication tube should be flush with the rear face of the bearing carrier.

8. Install the manifold gasket over the guide studs and against the bearing carrier. Install with the silicone bead up. No additional sealant should be used.

All Models

9. Install the manifold over the guide studs and dowel pins. On the Model MG-5600, assure that the shim retainer anti-rotation pins fit into the pockets in the inner face of the manifold. Secure with twenty two of M12-1.75 capscrews. Note that on the MG-5600, there are fourteen screws 50 mm long, and eight screws 70 mm long, and on the MG-5600DR, there are fourteen screws 70 mm long, and eight screws 90 mm long. Torque the capscrews to 112 Nm (83 lb-ft.).

10. With a felt-tip pen, make a radial mark on the rear end of each of the clutch shafts. Install a dial indicator on a machined surface on the manifold with the probe resting on the mark made on the clutch shaft. Note that the procedure for checking and setting the clutch shaft end play is the same for each shaft and must be done on each shaft.

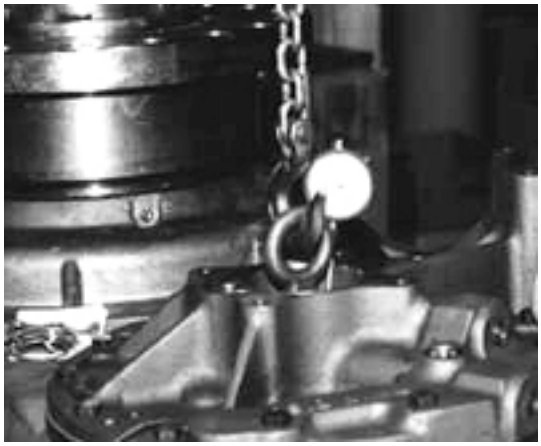


Figure 88. Measuring Shaft End Play

11. Exert 890 N (200 lbs) downward force onto the clutch shaft while rotating it several revolutions in each direction. Stop so that the dial indicator probe is resting on the felt tip pen mark and zero the dial indicator.

12. Remove the downward force and exert 1334 N to 1557 N (300 lbs to 350 lbs) of lifting force on the shaft. Rotate the shaft several revolutions in each direction, stopping with the dial indicator probe again resting on the felt tip pen mark, and record the dial indicator reading.

13. The reading is the clutch shaft endplay. Repeat for other clutch shaft, and record dial indicator reading. The shaft endplay should he between 0.05 mm to 0.15 mm (0.002 in to 0.006 in). Note the shim change that is necessary to achieve the desired endplay. If changes are necessary, for model MG-5600, repeat steps 9 through 12. If changes are necessary for model MG-5600DR, repeat steps 6 through 12. Use the dial indicator to confirm that desired endplay was attained, and record final results.

14. There should be two 10 mm diameter dowel pins protruding from the rear of the secondary shaft. If they have been removed, they must be installed. Install the oil pump drive adapter onto the secondary shaft, and secure with two capscrews (M8-1.25 x 20) and torque to 37 Nm (27 lb-ft.).

Installation of Manifold Exterior Components

1. Install the M10x1 o-ring plug into the recessed hole in the manifold near the primary clutch shaft, and torque to 26 Nm (19 lb-ft.). Install the M27 x 2 o ring plug in the rear center of the manifold and torque to 179 Nm (131 lb-ft.) Install the two M18 x 15 o ring plugs into the rear of the manifold and torque to 74 Nm (55 lb-ft.).

2. Install an o-ring into the groove in the face of the manifold at the primary shaft location, apply a bead of anaerobic sealant to the face of the primary shaft cover, and install the primary shaft cover to the manifold. Secure with four capscrews (M12-1.75 x 30), and torque to 112 Nm (83 lb-ft.).

3. Insert the splined pump drive adapter into the drive coupling assembly, and insert the retaining snap ring. Install this assembly over the oil pump shaft spline.

4. For units with manual control valve, install the oil pump gasket and oil pump onto the manifold with the slotted mount hole toward the flange. Grease the splines on the pump shaft and the splines in the adapter. Secure the pump with four capscrews (M12-1.75 x 40) with washers, and torque to.112 Nm (83 lb-ft.). For units with electric control valve, install the gasket and spacer, followed by the oil pump gasket and oil pump onto the manifold with the slotted mount hole toward the flange. Grease the splines on the pump shaft and the splines in the adapter. Secure the pump with four capscrews with washers (M12-1.75 x 90), and torque to.112 Nm (83 lb-ft.).

5. Install the suction screen into the suction tube inlet and install an o-ring onto both ends of the suction tube. Insert the suction tube into the housing and secure the suction tube to the oil pump with four capscrews, (1/2-13 NC x 1.25 in.) and torque to 88 Nm (65 lb-ft.).

6. Attach the oil filter head assembly and gasket to the housing with four capscews (M12-1.75 x 40) with washers, and torque to.112 Nm (83 lb-ft.). Apply a film of oil to the o-ring in the housing, and to the threads of the canister bolt. Insert a filter element, and tighten the canister bolt to 81 Nm (60 lb-ft.). Install the filter bypass valve (consists of poppet, spring, and plug with o-ring) into the filter head assembly, and torque to 108 Nm (80 lb-ft.).

Installation of Output Flange

Use of an SKE THAP 300 Oil Injection Kit or similar is required for tapered output shaft.

1. Clean the tapered surface of the output shaft and the tapered bore of the output gear. Use an OSHA approved cleaning solvent to remove all traces of dirt, grease, oil, etc. Loctite 7070 cleaner is recommended.

⚠ CAUTION

The tapered surface of the shaft and the matching tapered bore of the gear must be completely free of grease, oil, dirt or solvent residue. Failure to properly clean the mating parts could prevent the proper advance of the gear on the shaft and adversely effect the torque carrying capacity of the assembled joint.

2. Verify that when fully assembled, there will be a minimum of 0.05 mm (0.002 in.) clearance between the output flange hub retainer shoulder and the end of the output shaft. Measure the length of the output flange, and the distance from the end of the output to the shaft bearing face. This difference is the minimum clearance between the flange hub retainer and the end of the output shaft. If the clearance is out of tolerance, it is necessary to change parts. Contact the Product Service Department at Twin Disc, Inc. for assistance.

3. Coat the tapered surfaces of the output flange and shaft taper with thin oil.

4. Install the output flange onto the shaft with a retainer washer and three capscrews (M24-3 x 65). Connect the oil injection equipment to the output flange hub. Seat the flange onto the shaft taper, using a 1340 N (300 lbf) load.

5. Using a depth micrometer, measure the distance from the output flange retainer shoulder to the end of the output shaft. This distance will be the maximum available advance. The advance should be 10.16 mm to 12.35 mm (0.400 in to 0.486 in). Should the measured advance fall outside of the range given above, check to assure that all measurements and calculations are correct. If no errors are found and the expected advance is out of tolerance, it will be necessary to change parts. Contact the Product Service Department at Twin Disc, Inc. for assistance.

6. Remove the retainer washer and capscrews. Install pusher tool T-21413 and portable press onto the output shaft. Inject oil with a viscosity of 300 mm^2/S (300 Cst) at room temperature into the hub until it leaks out between hub and shaft. Continue injecting oil while using the portable press to push the output flange tight to the bearing face.

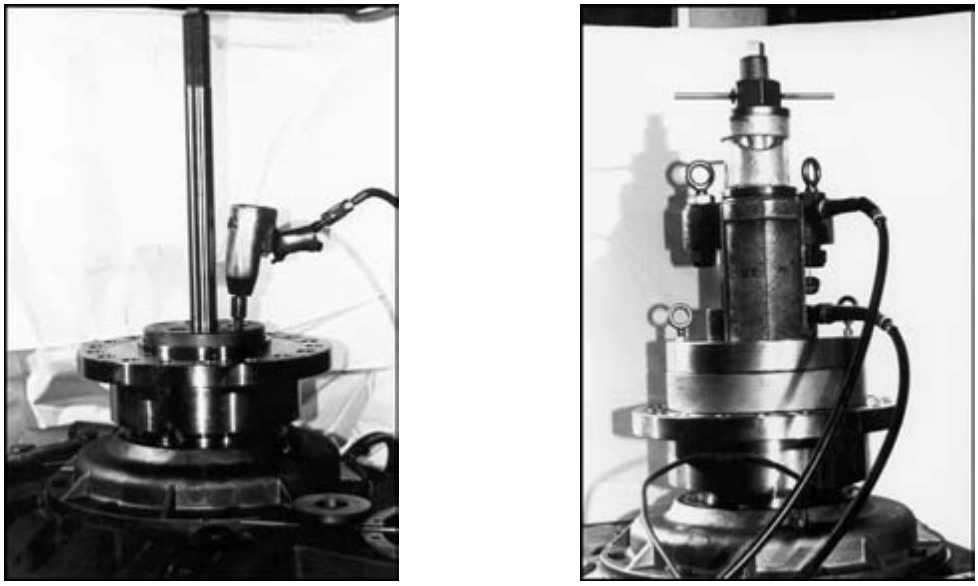


Figure 89. Install Tool T-21413 (left) and Inject Oil while Pressing Flange (right)

7. Release the injection oil pressure and wait five minutes before removing the pressure from the portable press. Check the actual advance.

8. Measure the distance from the end of the output shaft to the flange hub retainer shoulder. This distance, subtracted from the measurement from step 5, is the actual advance. Make a shim pack that will leave a clearance of 0.08 - 0.015 mm (0.002 - 0.006 in) between the retainer and the shaft. Install the retainer washer, shims and three capscrews (M24-3 x 65). Torque the capscrews to 912 Nm (673 lb-ft.).

9. Attach a dial indicator to the housing with the probe resting on the face of the output flange. Locate the indicator probe as close to the O.D. of the flange as possible. Check the flange face runout by rotating the flange. Total indicated runout must not exceed 0.10 mm (0.004 in).

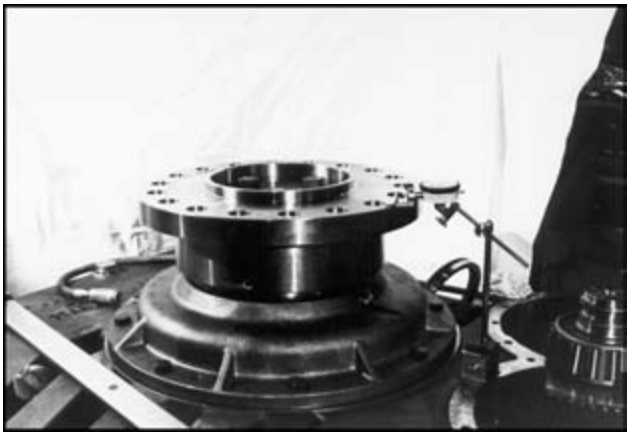


Figure 90. Check Face Runout of Flange

10. Attach a dial indicator to the housing with the probe resting on the O.D. of the output flange pilot. Check the pilot runout by rotating the output flange. The total indicated runout must not exceed 0.10 mm (0.004 in).

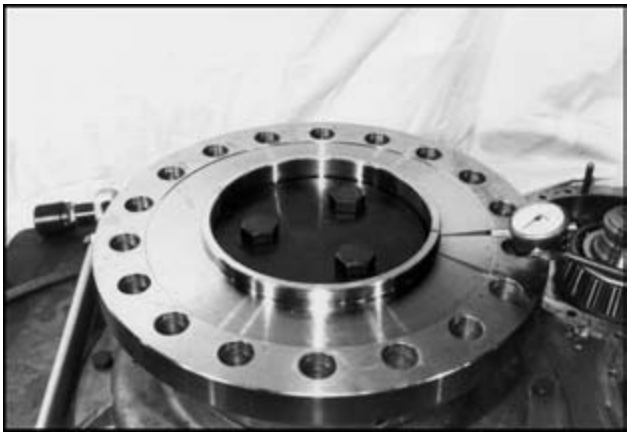


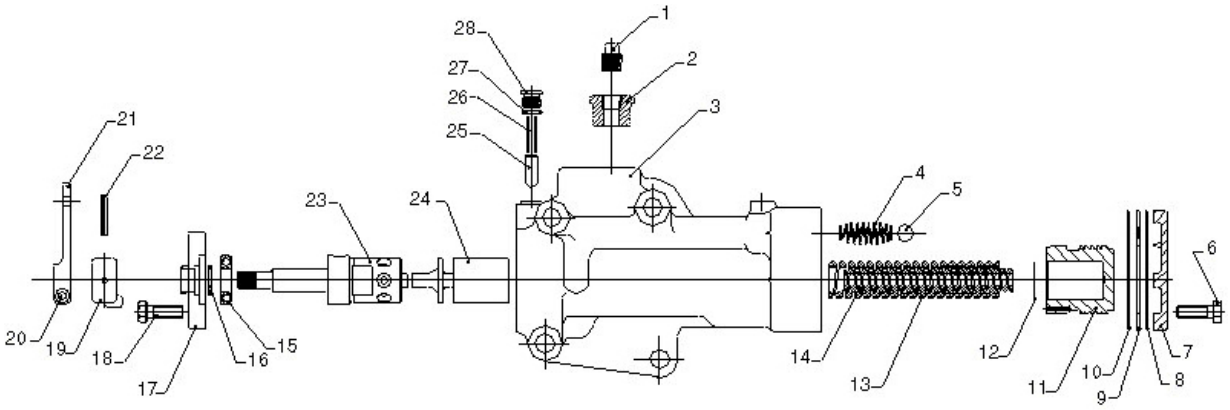
Figure 91. Check Pilot Runout of Flange

11. If the total dial indicator runout exceeds 0.10 mm (0.004 in) proceed as follows. With a felt tip pen, draw a line across the end of the output shaft and face of the output shaft counterbore to mark original installed position of the output flange versus the output shaft.

12. Remove the output flange (See Disassembly) and reinstall it 90 degrees from the original position. Recheck the runout of the flange face and the flange pilot using procedures in steps 9 and 10 above. If the runout is within the limit specified, the installation is complete.

13. If the runout continues to exceed the tolerance, repeat the procedure in 12 above at positions 180 degrees and 270 degrees from the originally installed output flange position. Repeat procedure 12 until the runout is no more than 0.10 mm (0.004 in).

14. If the output flange runout cannot be reduced to acceptable tolerances, contact your local Twin Disc Distributor for information or recommendations.



1	Plug	11	Rate of Rise Piston	21	Lever
2	Bushing	12	Shim	22	Pin
3	Valve Body	13	Outer Spring	23	Valve Stem
4	Spring	14	Inner Spring	24	Piston
5	Check Ball	15	Bearing	25	Detent
6	Capscrew	16	O-Ring	26	Spring
7	Oriface Cover	17	Cover	27	O-Ring
8	Gasket	18	Capscrew	28	Plug
9	Oriface Plate	19	Collar		
10	Gasket	20	Capscrew		

Figure 92. Selector Valve Exploded View

Assembly of Mechanical Control Valve

1. Install the bearing onto the valve stem.

2. Install the o-ring into the counterbore in the valve cover. Coat the o-ring and the stem with light assembly grease.

3. Install the valve stem into the valve cover. Use caution to prevent damage to the o-ring and bearing.

4. Install the cover gasket and valve stem and cover assembly onto the valve body.

5. Install the four of 5/16-18 x 1.25 capscrews, and torque to 20 Nm (15 lb-ft.).

6. Install the stop and rollpin, lining up the marks made at disassembly. Use small punch to line up the rollpin hole in the stop with the corresponding hole in the stem. Continue to hold the holes in alignment as the rollpin is driven into place. Support the stop while driving in the roll pin to prevent damage to the stem and valve.

7. Install the shift lever onto the stem, lining up the marks made at disassembly. Torque the screw to 15 Nm (11 lb-ft.).

8. Install the pressure regulator piston, regulating springs, shims and rate-of-rise piston into the bore in the valve body.

9. Install the spring and check ball, orifice plate gasket. Install the orifice plate with the chamfered side of the hole (check ball seat) toward the check ball. Install the cover gasket, cover, and four of 5/16-18 x 1.00 inch capscrews, and torque to 20 Nm (15 lb-ft.).

Assembly of Electrical Control Valve (upperbody half)

1. Install one dowel pin (large diameter) into each of the two bores of the valve body.

2. Install one spring into each of the two bores of the valve body.

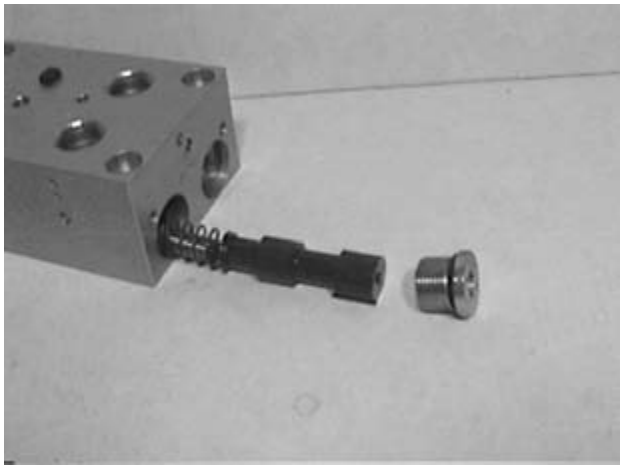


Figure 93. Dowel, Spring, Spool, and Plug

3. Install one spool into each of the two bores of the valve body.

4. Install the two o-ring plugs into the valve body and tighten to 85 Nm (63 lb-ft.)

5. Apply lubricant (such as Dow Corning 200® 30,000cSt fluid) to the o-rings of the solenoids and plug. Install solenoids and plug into the valve body and torque them to 34 Nm (25 lb-ft.).

6. Insert the wires (pins) into the Weatherpak connector according to the location markings made at disassembly. Close the end of the Weatherpak connector to lock the wires in position.

7. Install the Weatherpak connector onto its retaining clip on the top of the valve body.

Assembly of Electrical Control Valve (lower body half)

1. Install the steel shuttle ball into its bore in the valve body.

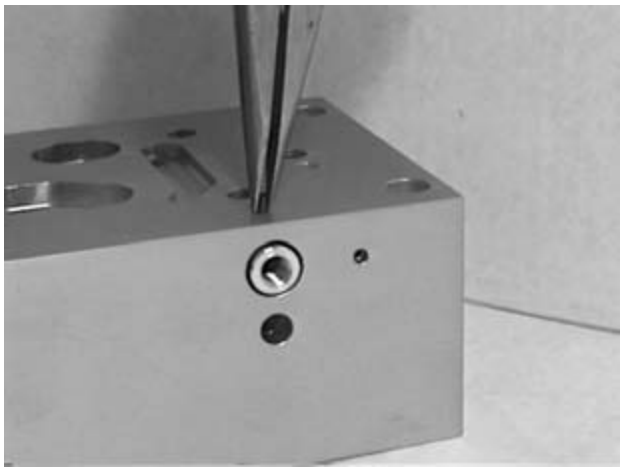


Figure 94. Shuttle Ball, Shuttle Seat, and Roll Pin

2. Install the o-ring onto the shuttle ball seat.

3. Apply lubricant such as Dow Corning 200® 30,000cSt fluid to the o-ring, and install the seat into the valve body. Be sure to align the roll pin holes in the seat with the holes in the valve body. A M8x1.25 screw threaded into the seat can be used to adjust the seat location in the valve body.

4. Install the roll pin to retain the shuttle ball seat. Drive the roll pin in until it is flush with the gasket surface of the valve body.

5. Install the stem into the valve body, aligning the slot in the stem with the threaded hole in the valve body for the dog-point setscrew. Be sure the slot in the stem is aligned with the setscrew hole in the valve body to prevent damage to the stem and valve body.

6. Apply MA908 threadlocker to the threads of the dog-point setscrew and install. Tighten the dog-point setscrew until snug, then back off 1/2 turn.

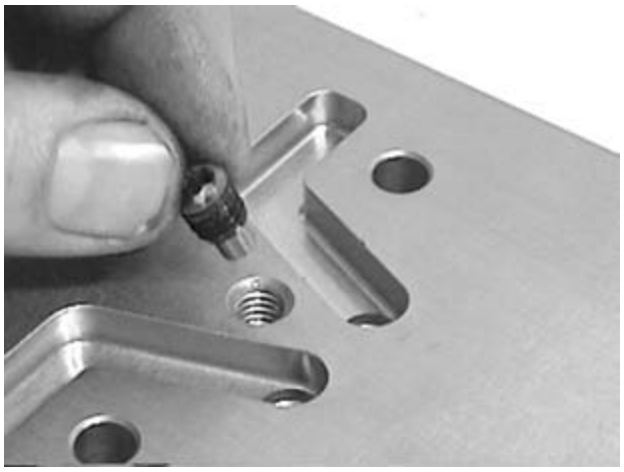


Figure 95. Dogpoint Setscrew with Threadlocker

7. Install the steel detent ball into the valve body.

8. Install the detent spring over the detent ball.

9. Apply MA908 threadlocker to the threads of the hollow setscrew and install into the threaded hole. A stepped Allen wrench, or one wrapped with tape will ease the installation of the hollow setscrew. Tighten the setscrew until it is flush with the gasket surface of the valve body. Check the stem rotation and detent action.

Figure 96. Detent Ball, Spring, Hollow Setscrew

10. Install the thrust washer over the end of the stem.

11. Press the oil seal into the cover assembly until flush with the adjacent cover surface.

12. Install the o-ring into the counterbore in the cover assembly.

13. Apply grease to the stem, o-ring, and oil seal lip.

14. Install cover assembly and gasket onto valve body. Be sure to align the oil drain hole in the gasket with the hole in the valve body.

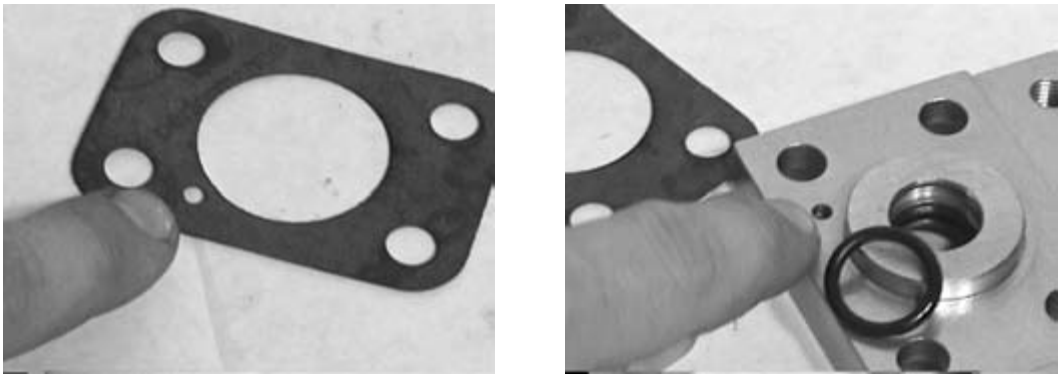


Figure 97. Hole in Gasket and Hole in Cover Must Align

15. Install four M8 x 25 socket head capscrews and torque to 23 Nm (17 lb-ft).

16. Install washer over stem and against oil seal.

17. Install spring over stem against washer.

18. Install lever onto the stem. It may be necessary to splay the lever to be able to install it. DO NOT apply any impact force to the lever, as the stem or dog-point setscrew may be damaged. Torque the lever's attaching screw to 9.5 Nm (7lb-ft).

19. Install external retaining ring onto stem .

20. Install the steel balls and electrical switches into the bores in the sides of the valve body. Note that the small diameter ball is inboard of the large diameter ball at each switch location.

21. Install the pressure regulating piston into valve body with spring pocket out.

22. Install pressure regulating springs into valve body and into piston spring pocket.

23. Install the shims that were removed into the bore of the rate-of-rise piston. Install the rate-of-rise piston over the springs and into valve body.

24. Install neutral pressure regulating spring into the pocket of valve body.

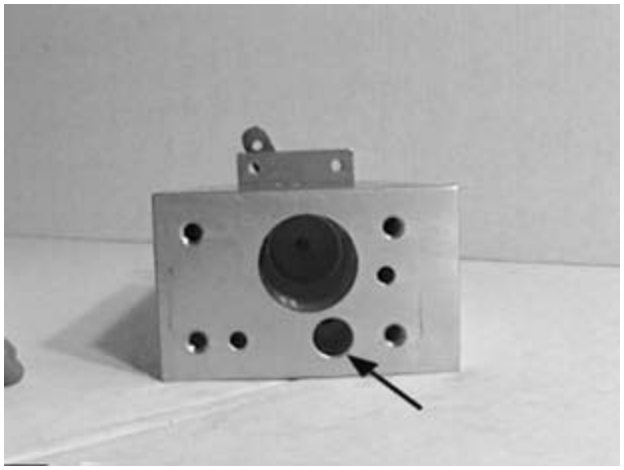


Figure 98. Location for Neutral Pressure Regulating Spring

25. Install orifice plate gasket onto valve body.

26. Install orifice plate and steel ball (against spring) onto valve body.

27. Install orifice plate cover and gasket onto valve body. Install four of M8 x 25 socket head capscrews and torque to 23 Nm (17 lb-ft).

28. Install gasket over lower valve body half.

29. Set upper valve body half over lower valve body half. Insert the M10 x 150 attaching screws through valve body halves to keep parts in alignment until installation onto the transmission. When installing the valve onto the transmission, torque the screws to 54 Nm (40 lb-ft.).

Selector Valve Installation

Manual Control Valve

Install the selector valve and gasket to the manifold and secure with four capscrews (two of M12-1.75 x.180, one of M12-1.75 x 90, and one of M12-1.75 x 45), and torque to 112 Nm (83 lb-ft.).

Electric Control Valve

1. Install gasket and ditch plate onto manifold, using four socket head capscrews (M12-1.75, and torque to 130 Nm (96 lb-ft.). Model MG-5600 has two capscrews 35 mm long, and two capscrews 120 mm long. Model MG-5600DR has two capscrews 35 mm long, and two capscrews 140 mm long. Torque these capscrews to 165 Nm (122 lb-ft.).

2. Install gasket and control valve assembly, using four socket head capscrews (M10-1.5 x 150), and torque to special value of 54 Nm (40 lb-ft.).

Input Reduction Components for Model MG-5600DR

1. Block and support the transmission assembly with the input end up. Use caution to avoid damage to the output flange and other external components.

2. Install sealing o-ring in the groove in the rear of the input reduction rear housing. Use a light coating of grease to aid in retaining the o-ring in the groove.

3. Using guide pins in two capscrew holes, lower rear housing over the pilot diameter of the main transmission housing, and insert a total of seventeen (eight of M16-2.00x60 and nine of M16-2.00x110) capscrews with copper washers. Torque to 275 Nm (203 lb-ft.).

4. Install the chilled rear bearing cups into the rear housing. Insure that they remain bottomed as the temperatures stabilize.

5. Install heated bearing cone assemblies onto the two input reduction gears if not previously installed.

6. Lower the internally splined reduction gear over the transmission splined shaft. This should not require force or heat to assemble.

7. Lower the input shaft and gear into the bearing cup, and into mesh with the mating gear.

8. Place the housing gasket over the housing face, using the dowel pins to locate the gasket.

9. Lower the input housing onto the gasket, engaging the dowel pins into the appropriate holes.

10. Install twenty eight capscsrews (M12-1.75 x 40), and torque to 130 Nm (96 lb-ft.).

11. Install the two bearing cups into the bores of the housing. These are loose fit in the bore.

12. Install the two bearing retainers on the housing and retain with at least three capscrews finger tight.

13. Using a feeler gauge, measure gap between the retainer flange and the housing, and assemble shim packs that are between 0.05 and 0.15 mm (0.002 to 0.006 in.) thicker than the measured gaps.

14. Press the input seal into the input bearing retainer so that it is flush with the front of the retainer. Install with the lip opening toward the transmission.

15. Install the o-rings on the o.d. of the pilot diameter of the bearing retainers, and install with the shim packs in place.

16. Assemble with eight capscrews (M12-1.75 x 40), in each retainer, and torque to 130 Nm (96 lb-ft.).

17. Rotate gears through at least three revolutions, and install dial indicator from the housing with the finger resting on the face of the gear or shaft. Mark location with a felt tip pen, and zero the dial indicator. Apply a lifting force equal to at least twice the weight of the gear and rotate through three revolutions, stopping with the dial indicator finger resting on the previously applied felt tip pen mark. Read the end play on the dial indicator. The proper end play for the reduction gears is 0.05 to 0.15 mm (0.002 to 0.006 in.). Adjust shim pack and recheck if necessary.

18. Remove the capscrews from the upper retainer, and install the o ring in the groove. Install the cover using the eight capscrews (M12-1.75 x 40), and torque to 130 Nm (96 lb-ft.).

19. The input hub is a tight fit on the shaft spline, and should be heated for installation. Install the washer and retaining snap ring into the input end of the flange. Lower the heated flange assembly over the shaft, and install three capscrews (M12-1.75 x 25) and torque to 130 Nm (96 lb-ft.).

20. Install fittings and front housing drain hose.

Installation of Remaining Transmission External Components (all models unless noted)

1. Turn the transmission and block securely in an upright position.

2. Install the input shaft oil seal for the MG-5600 into the housing bore using protector/driver T-18050-693. Coat the housing input shaft bore with M2828 anaerobic sealant. Install the oil seal with the open lip of the seal toward the inside of the housing. Press the seal into the bore flush with the inside face of the housing.

3. Install the top cover gasket. Use the four dowel pins to locate the gasket. Assemble the baffle to the cover, using three capscrews (M8-1.25 x 30) with washers and torque to 33 Nm (24 lb-ft.) if it had been disassembled. Install the top cover over the dowel pins, and secure with thirty capscrews (M12-1.75 x 35) with washers, and torque to 130 Nm (96 lb-ft.). Install the screen into the breather opening in the top cover, and install the breather assembly. Insert the appropriate capscrew through the clip prior to torquing. Install the two eyebolts and tighten.

4. Apply suitable pipe sealant such as teflon paste on the o.d. of the threads of the oil gauge tube assembly, and install the oil gauge tube assembly and oil level gauge. Use care that the tube goes straight down and not forward to avoid it being trapped in the output gear pan.

5. Install the heat exchanger using four capscrews (M10-1.5 x 25) and torque to 64 Nm (47 lb-ft.). Install the fittings into the heat exchanger if they have been removed, and connect heat exchanger hoses.

Model MG-5600 Remote Mounted Units

Note: It may be easier to install the input hub with the transmission assembly supported on the rear with the input end up. It is not necessary however.

The input hub is a tight fit on the shaft spline, and should be heated to 250° F for installation. Install the washer and retaining snap ring into the input end of the flange. Lower the heated flange assembly over the shaft, and install three capscrews (M12-1.75 x 25) and torque to 130 Nm (96 lb-ft.).

Model MG-5600 Close Coupled

1. Block and support the transmission assembly with the input end up. Use caution to avoid damage to the output flange and other external components.

2. Install the front housing to the front of the main housing. Secure SAE # 0 with eighteen capscrews (M16-2.00 x 45), and torque to 275 Nm (203 lb-ft.). Secure SAE # 00 with twenty-six capscrews (M16-2.00 x 45), and torque to 275 Nm (203 lb-ft.).

3. Mount a dial indicator on the input shaft spline with the probe on the front housing machined face. Rotate the input shaft and note the total indicator runout. The face runout must not exceed 0.41 mm (0.016 in) for both SAE #0. And #00 housings.

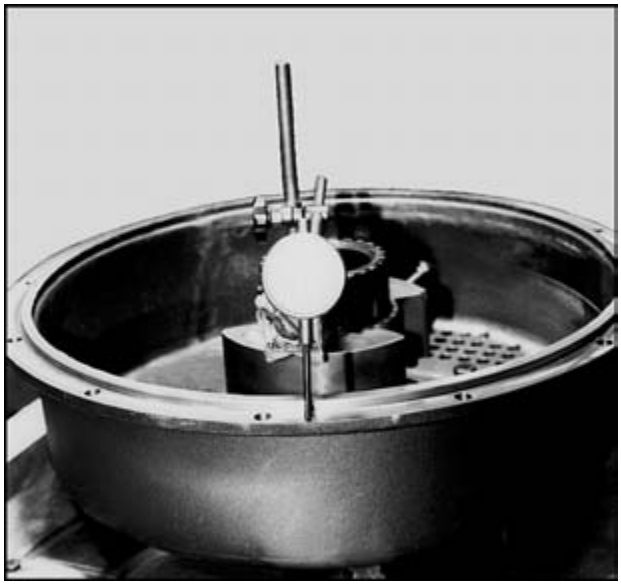


Figure 99. Measure Flywheel Housing Face Runout

4. Mount a dial indicator on the input shaft spline with the probe on the O.D. of the front housing pilot diameter. Rotate the input shaft and note the total indicator runout. The pilot runout must not exceed 0.30 mm (0.012 in) for both SAE #O and #00 housings. Should total indicator runout exceed the allowable limits, contact the Product Service Department of Twin Disc, Inc. for information and recommendations.

5. On close coupled models (mounted to the engine) the input shaft has loose fit splines. If the input coupling is going to be slipped onto the input shaft for shipment, it must be attached to prevent it sliding off and causing damage.

Installation

Prior to Installation

⚠ CAUTION

Most Twin Disc products mount directly onto the flywheel of the engine, or are attached to the flywheel through external shafting or adapters. Flywheel-to-driven component interference is possible due to mismatch of components or other reasons. Therefore, engine crankshaft endplay as well as flywheel alignment checks must be made before the driven component is installed.

After installation of the driven component, the crankshaft endplay should be measured again. The endplay at the second measurement should be the same as the first. A difference in these two endplay measurements could be an indication of interference. Consequently, the driven component should be removed and the source of interference found and corrected.

Twin Disc will not be responsible for system damage caused by engine to Twin Disc component interference regardless of the cause of interference. This engine crankshaft endplay check is considered mandatory.

The transmission housing flange and pilot, the engine flywheel and the flywheel housing must be checked for trueness. Clean the engine flywheel and flywheel housing mounting surfaces thoroughly before any measurements are made.

Note: To isolate engine vibration and prevent transferring it to the hull through the propeller shaft, the distance from the marine gear output flange to a fixed stuffing box or the first fixed bearing must be a minimum of 20 times the shaft diameter. If the distance is less than this, a flexible coupling may be necessary to isolate the engine vibration.

Alignment (also reference SAE J-1033 and J-617)

1. Bolt a thousandths increment dial indicator or gauge to the engine flywheel so that the indicator is perpendicular to the face of the engine flywheel housing, and the indicator stem is riding on the face of the flange.

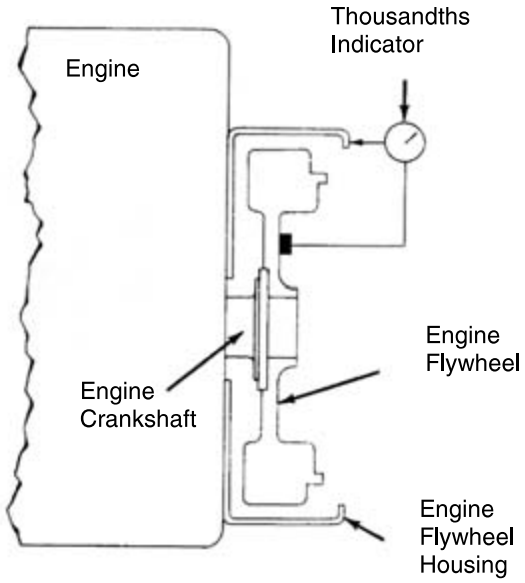


Figure 100. Checking Flywheel Housing Flange for Deviations

2. Rotate the engine flywheel, always keeping a thrust in the same direction, and note the face deviation of the engine flywheel-housing flange. The face deviation must not exceed the figures given in Table 15.

Table 15. Total Indicator Readings for Engine Flywheel Housing Flange

SAE Housing Number	Face Deviations and Bore Eccentricity mm (in)
00	0.48 (0.019)
0	0.41 (0.016)
1/2	0.36 (0.014)
1	0.30 (0.012)
2	0.28 (0.011)
3	0.25 (0.010)
4	0.23 (0.009)
5	0.20 (0.008)
6	0.18 (0.007)

3. With the indicator mounted as in the above paragraph, adjust the indicator stem so that it will ride on the bore of the engine flywheel housing.

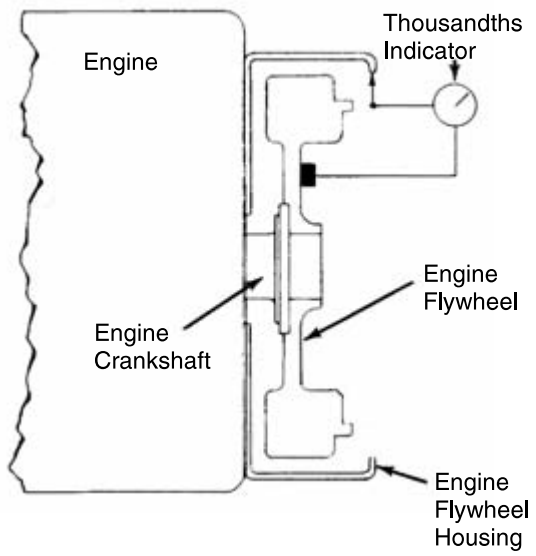


Figure 101. Checking Flywheel Housing Bore Eccentricity

4. Rotate the engine flywheel and note the bore eccentricity of the engine flywheel-housing bore. See the above Table for allowable tolerances.

5. Bolt a thousandths dial indicator or gauge to the engine flywheel housing so that the indicator is perpendicular to the engine flywheel, and the indicator tip is riding on the inner face of the flywheel. Rotate the flywheel. The variation of the face runout of the surface to which the driving ring is bolted should not exceed 0.013 mm (0.0005 in) per inch of diameter.

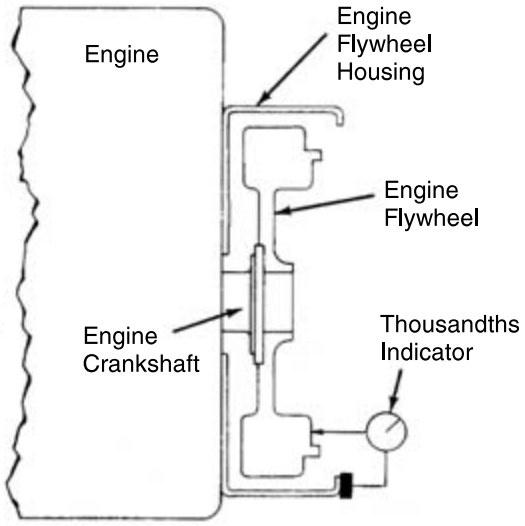


Figure 102. Checking the Flywheel Face Runout

6. With the indicator mounted as in the paragraph above, adjust the indicator tip so that it will ride on the driving ring pilot bore of the engine flywheel. Rotate the flywheel. The driving ring pilot bore eccentricity of the engine flywheel should not exceed 0.13 mm (0.005 in) maximum total indicator reading. Thrust on the flywheel should be in one direction at all times to obtain a correct reading.

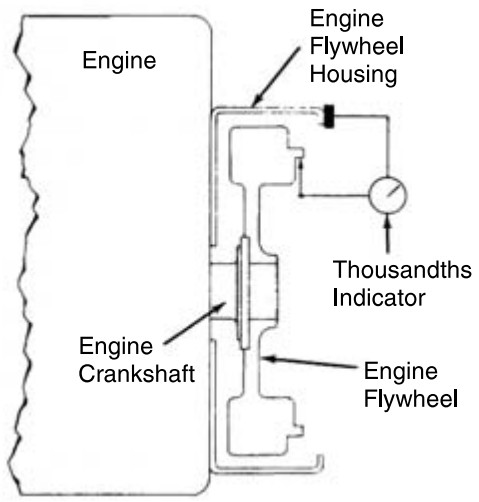


Figure 103. Checking the Flywheel Pilot Ring Bore Eccentricity

7. Readjust the indicator so that the tip will ride on the pilot bearing bore of the flywheel. Rotate the flywheel. The eccentricity of the pilot bearing bore should not exceed 0.13 mm (0.005 in) maximum total indicator reading. Eccentricity between the driving ring pilot bore and pilot bearing bore should not exceed 0.20 mm (0.008 in) total indicator reading.

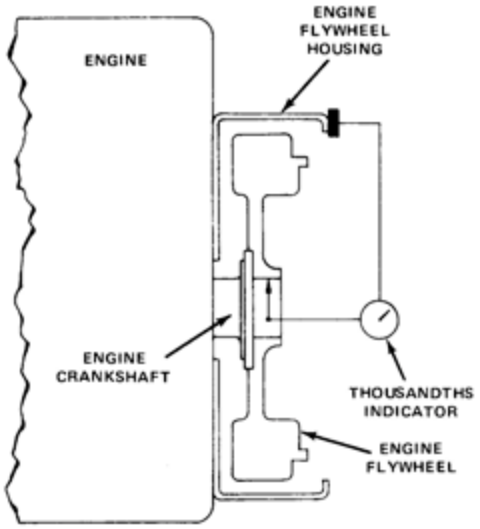


Figure 104. Checking the Flywheel Pilot Bore Eccentricity

Installation

Alignment

Proper alignment of an engine and marine unit is critical, both during the initial installation and at frequent intervals during the life of the boat. It is rather common for a boat to change its form with various loads and with age. Engine and shaft alignment can also change on a boat due to varying loads and the boat's age. The following steps may be taken to secure proper marine transmission alignment.

When reinstalling a marine gear after a repair, or when installing a new marine gear to an engine already mounted in the bed rails, the flywheel housing should be checked for deflection using the following procedure:

Install the mounting brackets on the side mounting pads of the marine gear. Install the driving ring on the engine flywheel. Bolt an indicator to the engine block and set the indicator stem on the engine flywheel housing

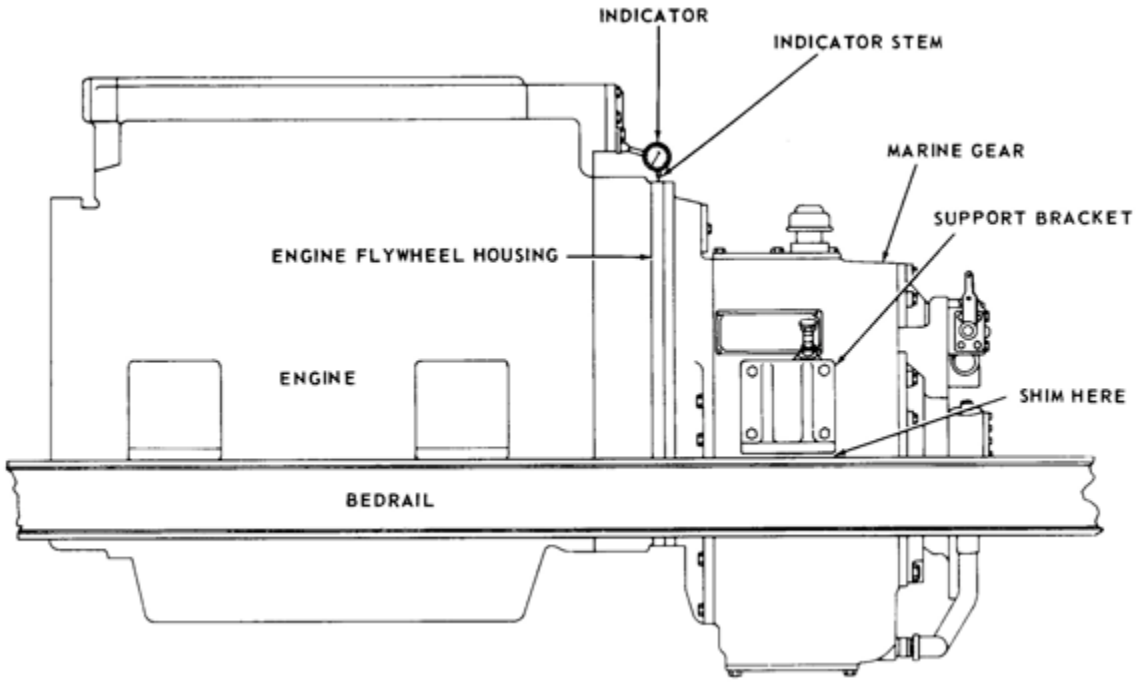


Figure 105. Marine Gear Alignment

Set the indicator gauge at zero (0). Lift the marine gear with a hoist, or other suitable means, and place the unit in position against the engine flywheel housing. Secure the flange of the marine gear main housing to the engine flywheel housing. Use a feeler gauge between each mounting bracket and engine bed rail. Add shims between the brackets and bed rails to equal the feeler gauge readings. Carefully release the lifting force on the marine gear while observing the indicator. The indicator gauge must remain steady at the zero mark. Torque the bed bolts to the proper rating. If the reading moves from zero, lift the marine gear and insert additional shims. Continue this procedure until the marine gear is completely at rest on the bed rails and the gauge maintains a steady zero reading. After obtaining the correct zero reading, indicating no distortion of the engine flywheel housing, secure the mounting brackets to the engine bed rails. Before securing the mounting brackets to the engine bed rails, the propeller shaft should be checked for alignment.

Note: The transmission output flange and companion flange bolts must be torqued to the proper value as identified in Description and Specifications.

Torsional Input Coupling Alignment - Free Standing Units

Alignment of freestanding transmissions must begin by aligning the transmission output flange to the propeller shaft. The engine must then be moved to properly align the engine flywheel to the transmission input hub.

Engine and Marine Transmission Alignment

⚠ CAUTION

When mounting the engine and transmission in the boat, all of the mounting pads on both the engine and transmission must be used. Failure to do so may result in damage to the transmission or the engine flywheel housing.

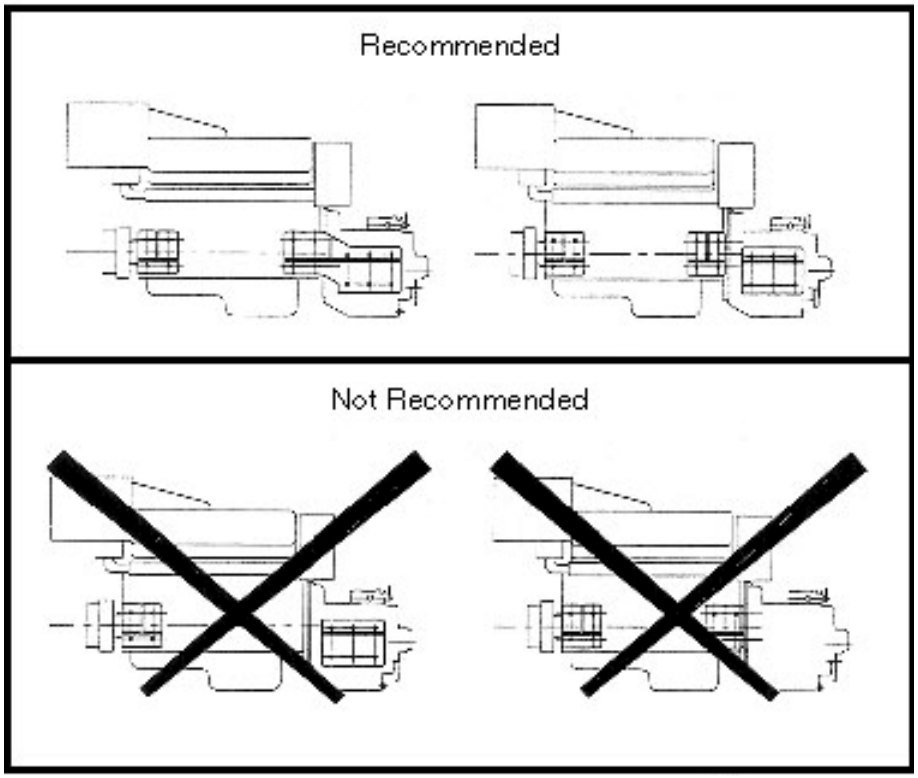


Figure 106. Transmission Mounting Configurations

When mounting the engine and transmission in the boat, all of the mounting pads on both the engine and the transmission must be used. Failure to do so may result in damage to the transmission.

It is important to align the engine and transmission only when the boat is afloat, and NOT in dry-dock. During this alignment period, it is also advisable to fill the fuel tanks and load the boat in the typical manner that it is to be used. Some boats are built with flexibility and may change shape as the loading varies.

When a heavy boat is dry-docked, it naturally undergoes some bending. Therefore, it is always good practice to unbolt the marine transmission coupling to prevent bending of the shaft.

With the engine and transmission in position on the engine bed, arrangements must be made to have a controlled lifting or lowering of each of the four corners of the engine. If threaded holes are provided in each of the engine mounts, jacking screws can be used in them. The engine can be raised by screwing down, or lowered by backing off on the jacking screws to obtain the desired adjustment.

Steel plates must be inserted under the jacking screws so that the bolts will not damage the engine bed. Lifting can also be accomplished by the use of chain hoists or properly placed jacks. Adjustable shims also are available and can simplify the alignment process, particularly for future realignment.

It may also be necessary to move the engine and transmission to one side or the other on the engine bed to obtain horizontal alignment. This can be done with a jack placed horizontally between the engine and the foundation. At the same time, a straight edge is laid across the edges of the flanges at the top and side to check the parallel alignment of the coupling edges.

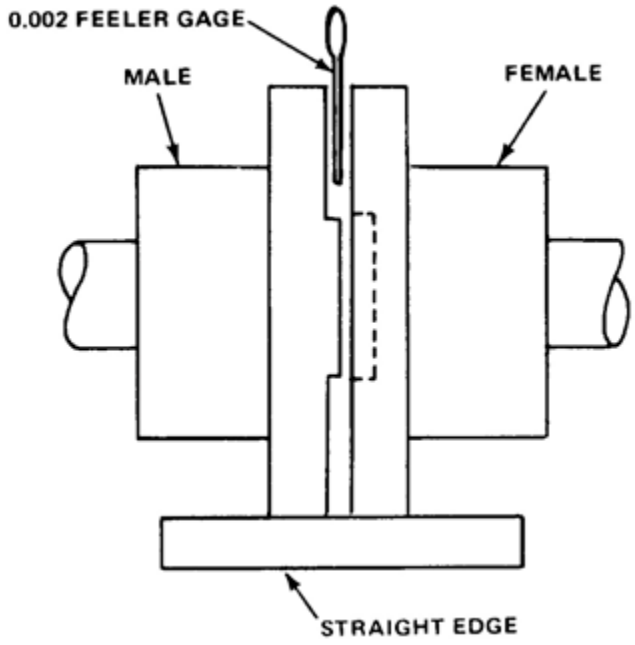


Figure 107. Checking Parallel Alignment of the Coupling

As the engine and marine transmission come into their aligned position, it will be possible to mate the output flange and propeller coupling, and prepare for bolting together. Care should be taken not to burr or mar this connection because the fit is very critical. Place a 0.05 mm (0.002 in) feeler gauge between the flanges of the coupling. Move (slide) the feeler gauge completely around the coupling. Rotate the marine transmission flange coupling in 90 degree increments, and move the feeler gauge around the flange in each successive position. The feeler gauge will fit snugly, with the same tension, all around the flange coupling in all four positions if the alignment is correct.

If the alignment varies during rotation, additional alignment is necessary, or the marine transmission and shaft couplings should be checked for proper face runout. Runout must not exceed 0.10 mm (0.004 in). Excessive face runout on the marine transmission output flange can usually be corrected by repositioning the coupling on its spline or taper. Excessive shaft coupling runout is usually due to inaccuracy of the taper fit or key to keyway interference. The optimum relative mating location will be where the measured runout dimensions of the transmission flange and the shaft coupling flange compliment each other to result in the least relative out of true parallel measurement.

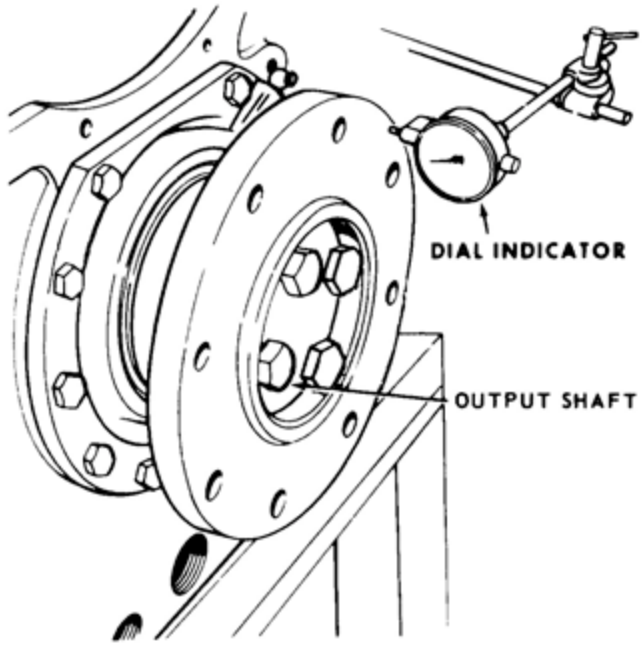


Figure 108. Checking Output Flange Face Runout

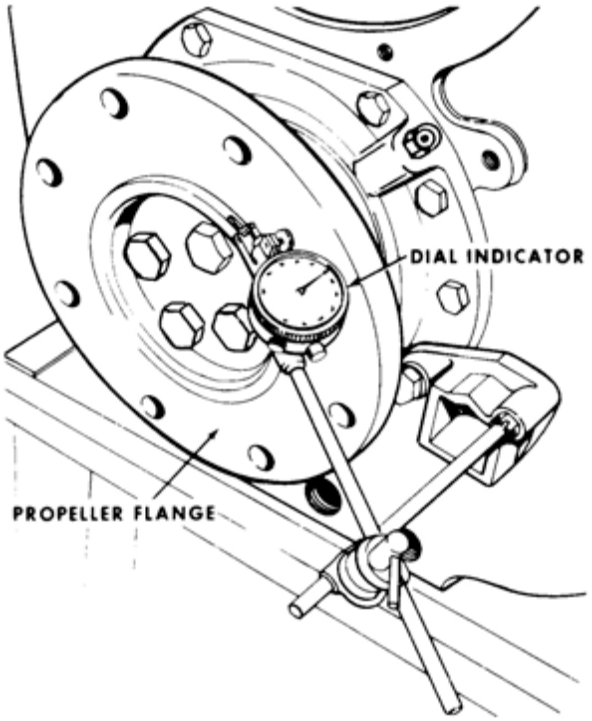


Figure 109. Checking Output Flange Pilot Eccentricity

Some boats are not structurally rigid and some carry their load in such a way that they will “hog” or go out of normal shape with every loading and unloading. Where this condition exists, it important to apply common sense alignment techniques to minimize the potential damage to any of the components.

During the process of securing final alignment, it may be necessary to shift the engine many times. When the final alignment is accomplished, mark and drill the holes for the lag studs or locating dowel pins. Then with final alignment secured, make up the necessary poured, steel, or hardwood shims, and fasten the engine and transmission in place. Then recheck the alignment, and if satisfactory, bolt the coupling together.

There are many types of flexible couplings in the market today that solve a variety of problems:

- Couplings to reduce noise and vibration.
- Couplings to allow a permanent angular misalignment.
- Couplings that allow engines to be flexibly mounted and take out the momentary misalignment.

In some cases, the proper alignment of these couplings requires an accuracy equal to that of rigid couplings. Always use the alignment procedures recommended by the coupling manufacturer.

Torsional Input Couplings Installation - Free Standing Units - For Models Provided by Twin Disc

Assembly Instructions for CENTAFLEX - R on Flange Mounted Gears. Information Taken Directly from CENTA Drawing 26-60062-91-3.

1. Bolt flywheel flange onto flywheel and tighten bolts as follows.

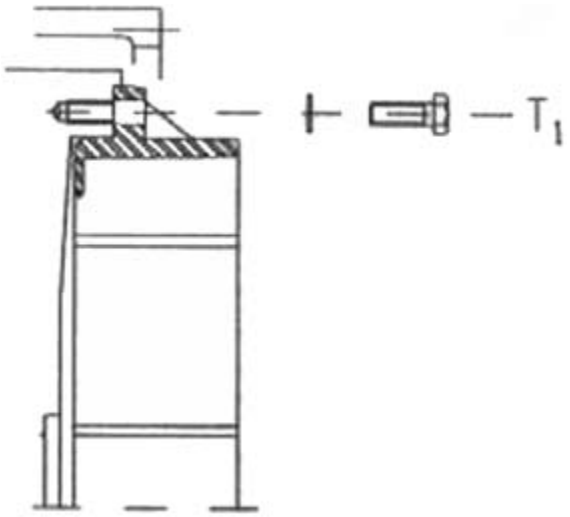


Figure 110. Assemble Flywheel Flange to Flywheel

Table 16. Centa Torque Chart

SAE	Bolt	Grade	Tightening Torque	
			(Nm)	(inch-lbs.)
11.5	M10	8.8	50	433
14	M12	8.8	85	738
18	M16	8.8	215	1868
21	M16	8.8	215	1868

Tightening torque is for slightly oiled bolts, tolerance is + or - 5%. Securing of the bolts by adhesives (e.g. Loctite) is possible.

Assembling of output hub: (This procedure is for gears with splined shaft, where the output hub of the coupling is axially free.)

2. Place rubber rollers in the deepest section of the cam in the output hub. Normally they stick there by friction.

Figure 111. Insert Rollers and Note Alignment

3. In case, that they should not stick, place a tape or a cord with a slipknot around all rollers close to the gear side. Let the end of the tape or cord long enough, that it is hanging outside the flange. Turn the two couplings halves in a position, that the arrows of both halves are just opposite See Figure 111 (View X).

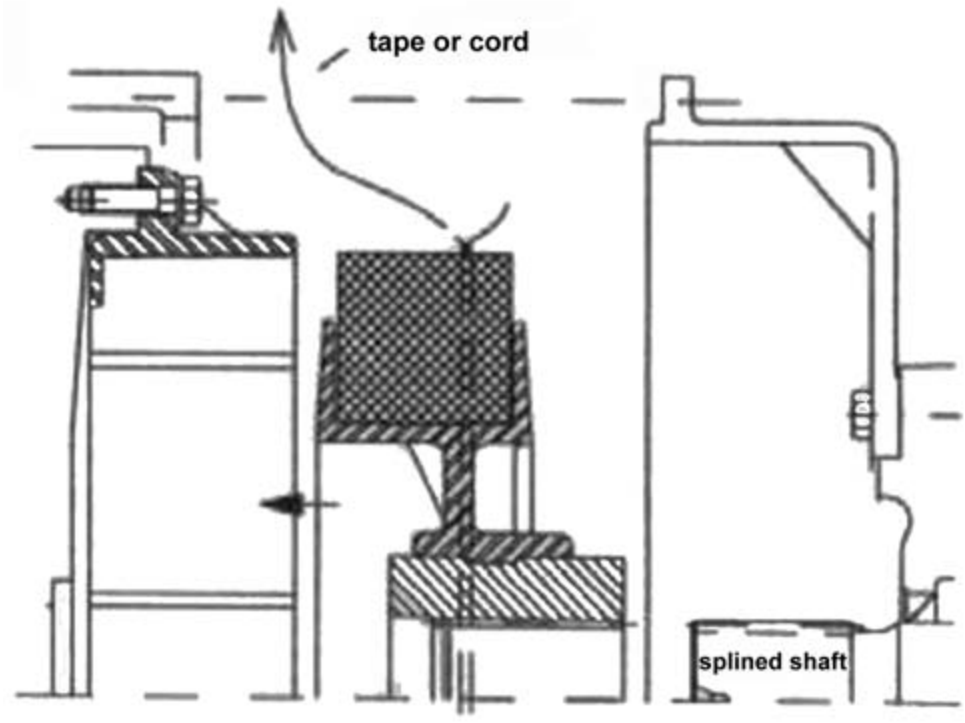


Figure 112. Coupling into Flywheel Flange

4. Then push the output side of the coupling with the gear into the outer flange. If necessary apply some lubricant on the outer flange. Suitable lubricants are soap water, detergents, etc., but no oil or grease. In case a tape or cord had to be used, push the coupling only half way together and then take the long end of the tape or cord and pull it away. Then grease or oil the gear shaft and plug it into the coupling spline.

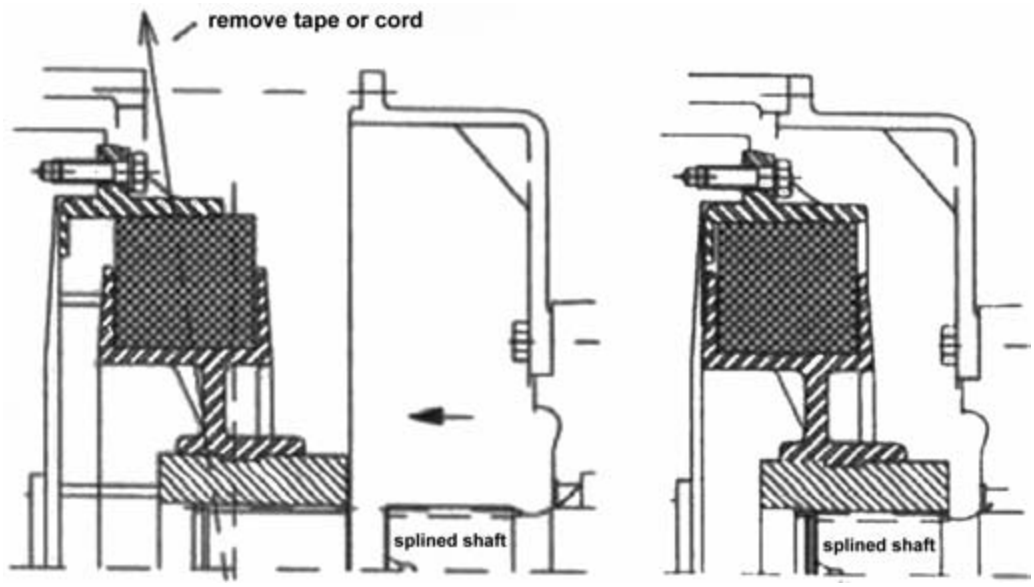


Figure 113. Final Assembly

5. Bolt the gear flange to the flywheel housing.

Note: When bolting the gear flange to the flywheel housing, make sure that no axial thrust is exerted to the coupling by tightening of the bolts. Before the engine is started the first time, check that the crankshaft has endplay, otherwise serious damage may occur to the engine.

Assembly Instructions for CENTA L Series CX-72 Torsional Couplings used with Free Standing Transmissions (Information taken directly from CENTA Technical Manual) Remote Centa CX 72 Coupling

⚠ CAUTION

The following steps must be followed at any time that the coupling is being worked with.

1. Take precautions to prevent accidental start-up of the equipment.
2. Use appropriate lifting equipment for handling the heavy parts.
3. Identify the parts by referring to the drawing that follows.
4. Inspect the coupling for any damage prior to assembly
5. Clean all connecting surfaces of the coupling parts, engine flywheel and transmission input flange.
6. The engine and transmission must be properly aligned.

Initial Coupling Installation

See Figures 117 and 118.

1. Mount the output flange (9) to the input shaft of the transmission. Establish the proper axial spacing between the engine and transmission and align the engine to the transmission.

Table 17. Alignment Specifications for Centa Coupling

Allowable axial displacement △Ka [mm]	
continuous	±6.5
transient	±13
Allowable radial displacement △Kr [mm]	
continuous	5.0
transient	10.0
Allowable angular displacement △Kw [<)	
continuous	0.5
transient	1

2. Note that the following subassembly comes pre-assembled. This consists of the rubber elements (1), flywheel flange (2), centrifugal protection ring (3), fail safe ring (4), link flange (5), centering pin (7), spacer (8), M16x35 socket head capscrew (10), M16 nut (11), M16x50 socket head capscsrew (12), screw (14), centering pin (15), and snap ring (16).

3. Lower the subassembly into position and secure to the engine flywheel. These bolts are not supplied, and must be torqued to specifications shown in Description and Specifications section.

4. Mount the links (6) so that the pilot on the sleeves fits into the recess in the link flange (5) and the output flange (9). Tighten the M27 bolts to 1400 Nm.

5. The coupling must be shielded to meet safety regulations while providing adequate ventilation.

Complete Disassembly

1. Remove the axial bolts (M27x100) and the radial bolts (M27x120). Remove the links (6).

2. Support the subassembly and remove the bolts that secure the coupling to the engine flywheel.

Subassembly Disassembly

1. Remove the M16x50 socket head cap screws (12) which secure the flywheel flange (2) to the rubber element (1) and centrifugal protection ring (3). The flywheel flange can now be removed.

2. Remove the M16x35 socket head cap screws (10), M16 nuts (11), and spacers (8). Use care to not lose the centering pins (7) and snap rings (16), the two rubber elements (1) can now be separated.

3. Remove the screws (14) which secure the centrifugal protection ring to the rubber element (1). the rubber element (1) and the centrifugal protection ring (3) can now be separated.

4. Remove the M16x50 socket head cap screws that secure the fail safe ring (4), rubber element (1), and link flange (5). These components can now be separated.

Reassembly of Subassemblies

1. Assemble the link flange (5), fail safe ring (4), and the rubber element (1) with the M16x50 socket head capscrews (12). Line up the centering pins (15) with the rubber element (1) flange.

2. Assemble the rubber element (1) and the centrifugal protection ring (3), using the supplied screws (14).

3. Assemble the rubber element (1), centrifugal protection ring (3), and the flywheel flange (2) with the M16x50 socket head cap screws (12).

4. Assemble the two rubber elements (1) together using the M16x35 socket head cap screws (10), M16 nuts (11), and spacers (8). Use care to line up the centering pins (7). Make sure the jaws of the centrifugal protection ring (3) and fail safe ring (4) are oriented 90^{o} apart from each other.

5. Make sure all fasteners are properly torqued to specifications.

Centa L Series CX-72 for Free Standing Transmissions

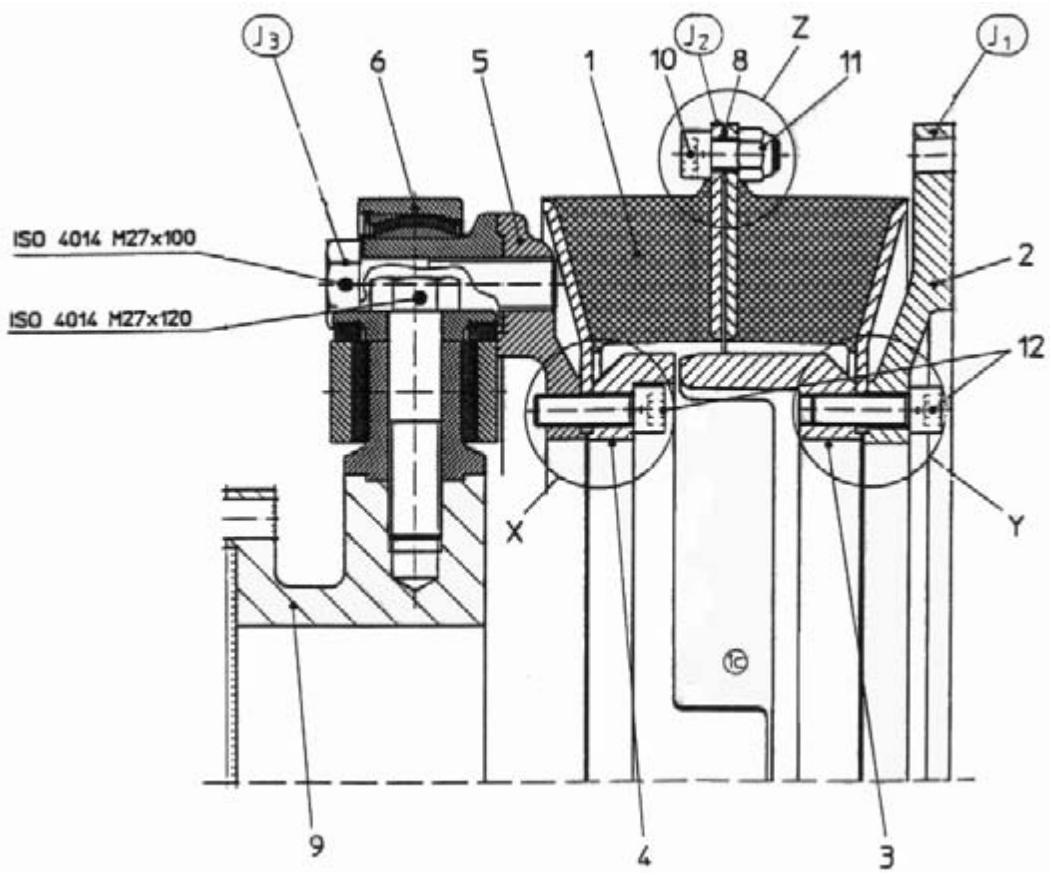


Figure 114. Parts Identification - Centa CX-72

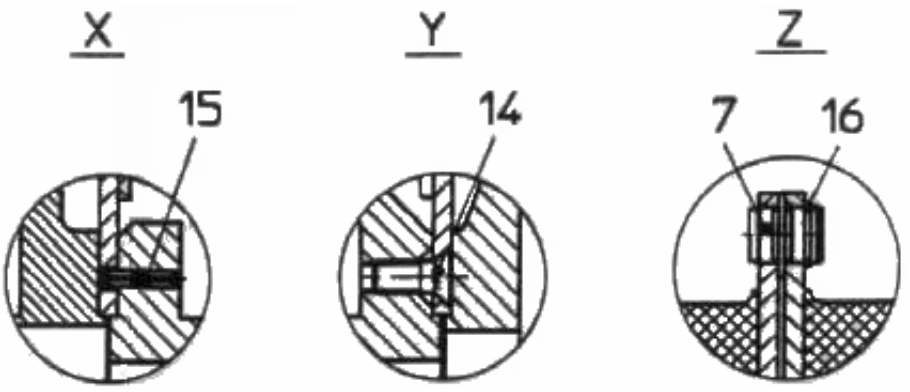


Figure 115. Enlarged Views

Installation of VULKAN RATO - R Coupling with freestanding Transmissions (Information extracted from VULKAN Manual E12048E)

Refer to Figures 116 through 121 on the following pages.

Note: The engine and transmission must be aligned prior to installation of the coupling. The following allowable tolerances are taken from the Vulkan Service manual. Complete alignment instructions are available from Vulkan.

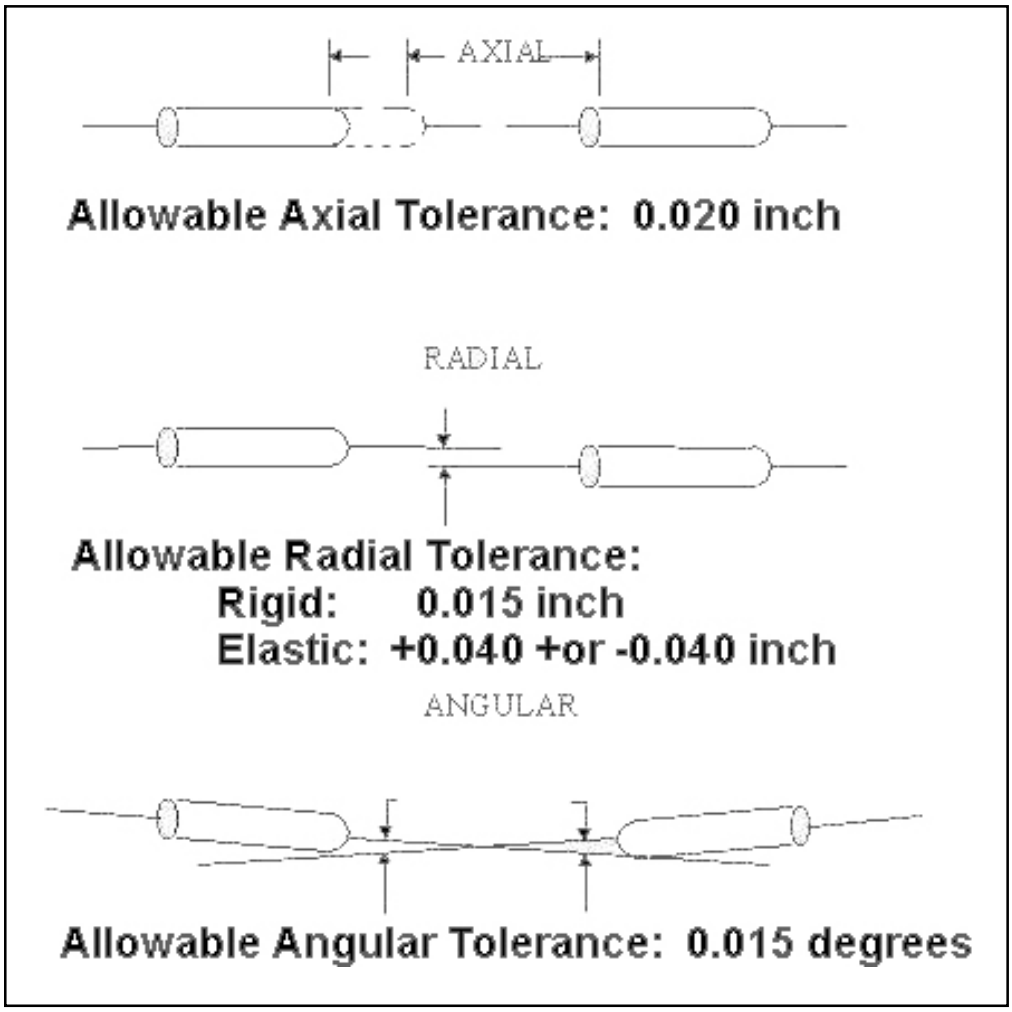


Figure 116. Allowable Alignment Tolerances for Vulkan Coupling

Note: The coupling assembly must be partially disassembled prior to installation between the engine and transmission.

1. Remove the input flywheel adapter flange (Item 43).

2. Remove the output end flexible membrane with spacer (Item 10).

   Note: The spacer should not be removed from the flexible membrane at any time, and the bolts that hold the two flexible elements together should not be removed as this would be detrimental to maintaining the proper runout tolerances. The intermediate ring (Item 46) or safety ring (item 48) if so equipped should not be removed.

3. Attach the input flywheel adapter flange (Item 43) to the engine flywheel and torque the bolts as shown in the torque chart in Description and Specifications. These bolts are not supplied with the coupling.

4. If not already installed, the transmission hub must be installed on the transmission input shaft.

5. Mount the flexible membrane and spacer (Item 10) to the hub with the flexible membrane toward the transmission. It may be temporarily held in place with capscrews through the hub.

   Note: Alignment marks exist on the flywheel adapter, flexible element, and spacer on the transmission side. Refer to Figure 120.

6. Suspend the flexible elements (Item 1) from a hoist, and install one capscrew to properly align the flexible element to the flywheel adapter, and roll the flexible element into place. (See Figure)

7. Apply Loctite 242 and install the capscrews and washers (Item 39 and 44) into the flywheel adapter and torque to 86 lb-ft. (116 Nm).

8. Remove the temporary capscrews that were used to hold the flexible membrane rearward on the transmission hub.

9. Install the bolts and washers through the flexible elements and the spacer and flexible membrane. Install the copper washer, hardened washer, and nuts. (Items 16, 19, 28, 39, and 41). Torque to 86 lb-ft. (116 Nm).

10. Insert the split ring between the transmission input flange and the coupling output element, and install the capscrews and torque to the value shown in the torque chart in Description and Specifications.

Removal of Vulkan Rato- Coupling

Reverse the steps for assembly for removal from the installation.

Assembly Specifications

The following notes are referenced in Figures 117 and 118.

1 Refer to Installation for proper installation procedures.

2 The hardware is secured with Loctite 242 at final installation.

3 The axial spacing dimension must be corrected for the thermal expansion of the system.

4 The hardware is supplied untorqued.

7 **⚠ CAUTION**

Removal of indicated bolt will alter coupling runount tolerance.

Table 18. Bolt Torques (based on unlubricated conditions)

Item	lb - ft	Nm
1.3	47 - 51	63 - 70
28	82 - 89	110 - 121
44	82 - 89	110 - 121
47	24 - 26	32 - 36

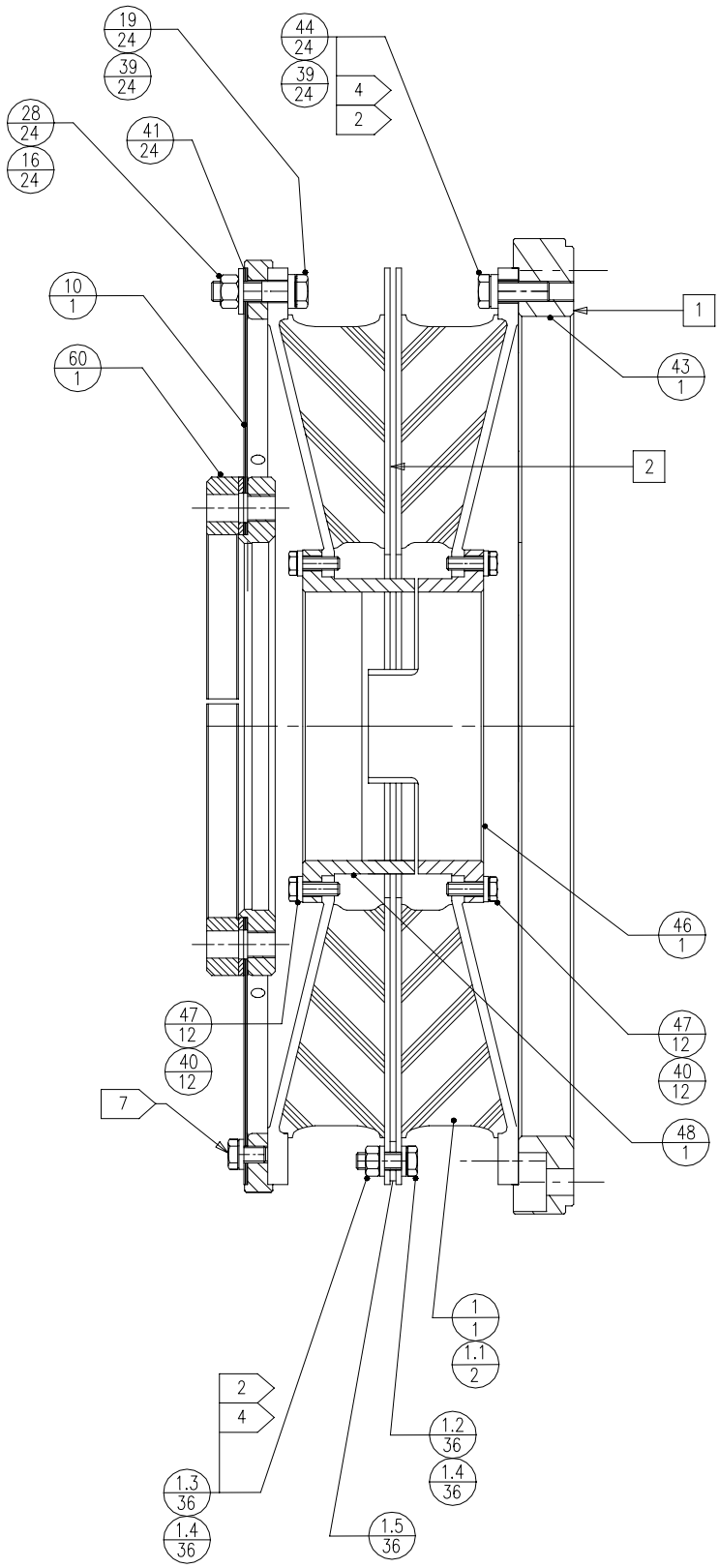


Figure 117. Vulkan Rato-R with Mechanical Stop

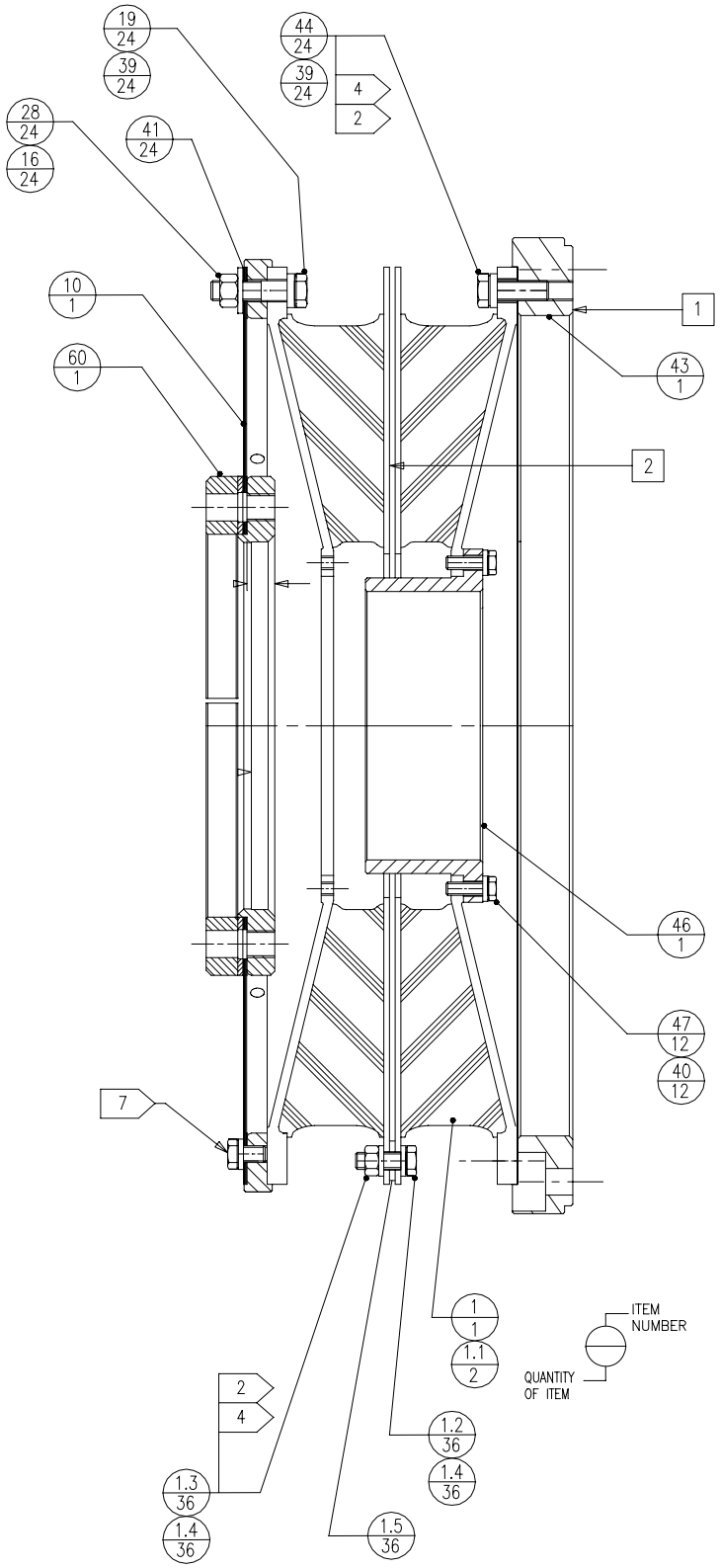


Figure 118. Vulkan Rato-R without Mechanical Stop

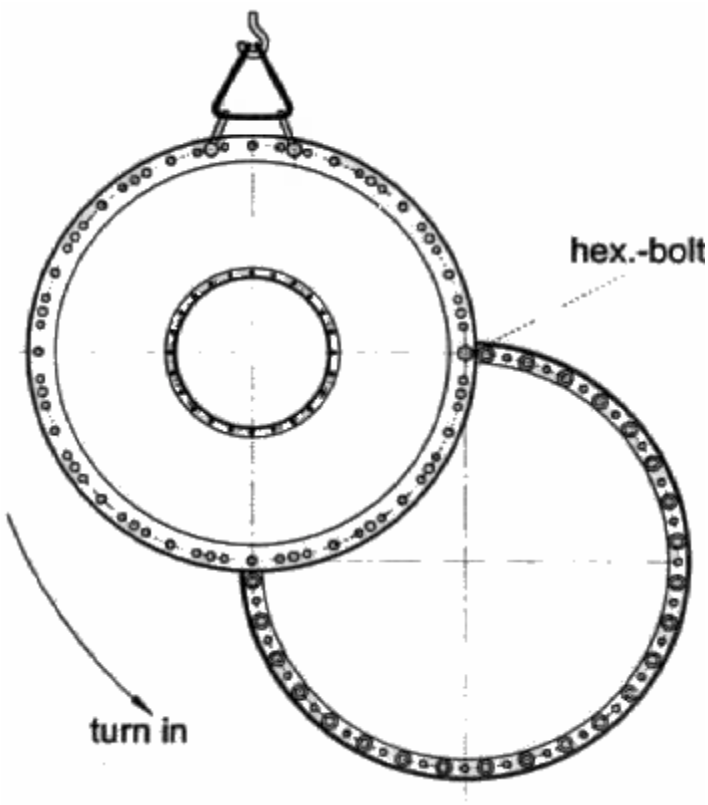


Figure 119. Roll Coupling into Housing

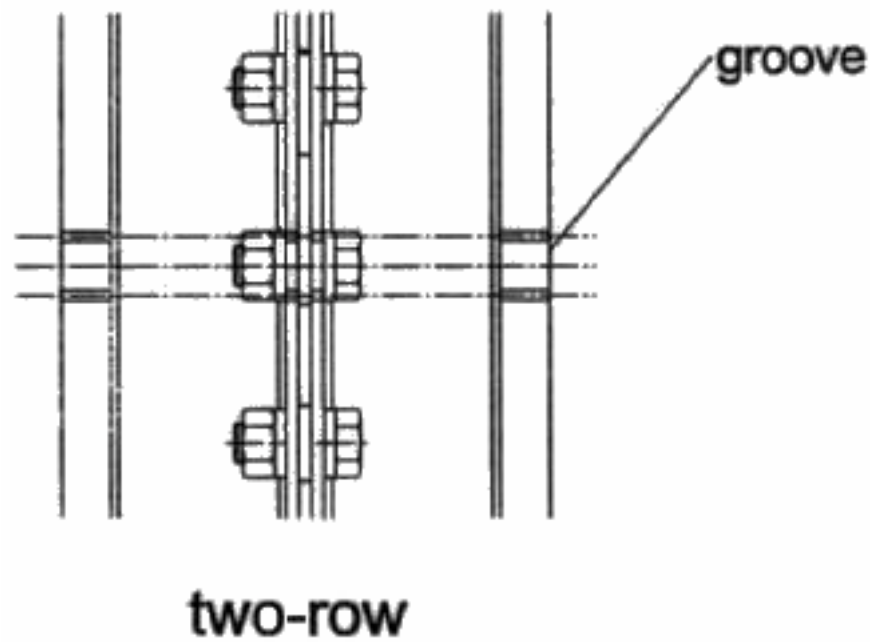


Figure 120. Alignment Marks

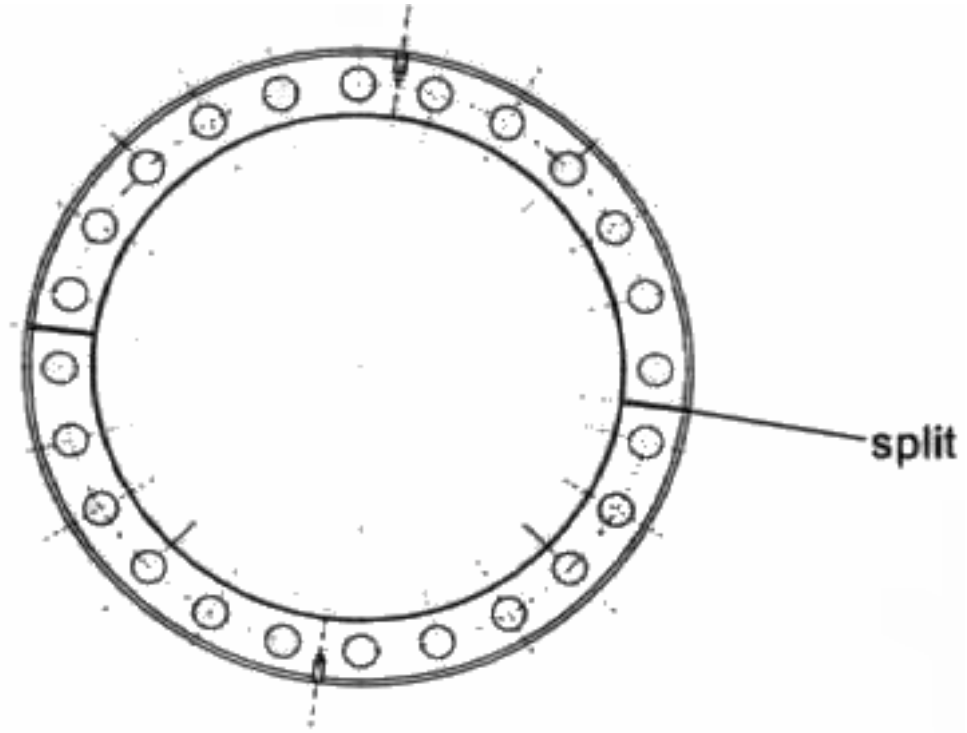


Figure 121. Split Ring

Propeller Shaft

Before any attempt to align the engine and gearbox to the propeller shaft, proper alignment of the propeller shaft must be determined. This includes alignment of the propeller shaft through all struts and intermediate bearings. Failure to properly align the propeller shaft may result in premature wear on bearings, vibrations, or possible damage to other components.

If the length of the shaft from the last support bearing to the gearbox is excessive or a flexible stuffing box is used, the shaft must be centered prior to engine and gearbox to propeller shaft alignment.

Transmission Controls

⚠ CAUTION

Transmission controls must be checked for proper function and alignment after any transmission selector valve is properly indexed in relation to the operator's control lever. Failure to do so could cause control system malfunction, resulting in personal injury and or damage to equipment and property.

See specific marine transmission installation drawings for detail and dimensional information needed for the proper installation of control linkages, power engaging devices, or electrical connections.

Mechanical Controls

Movement of the operator's selector lever to the forward, neutral or reverse position must result in the transmission control valve selector being positioned in the forward, neutral or reverse detent location. Cables and linkages must be supported properly and not have any excessive slack that will allow relative movement between the operators selector lever and the transmission control valve selector lever.

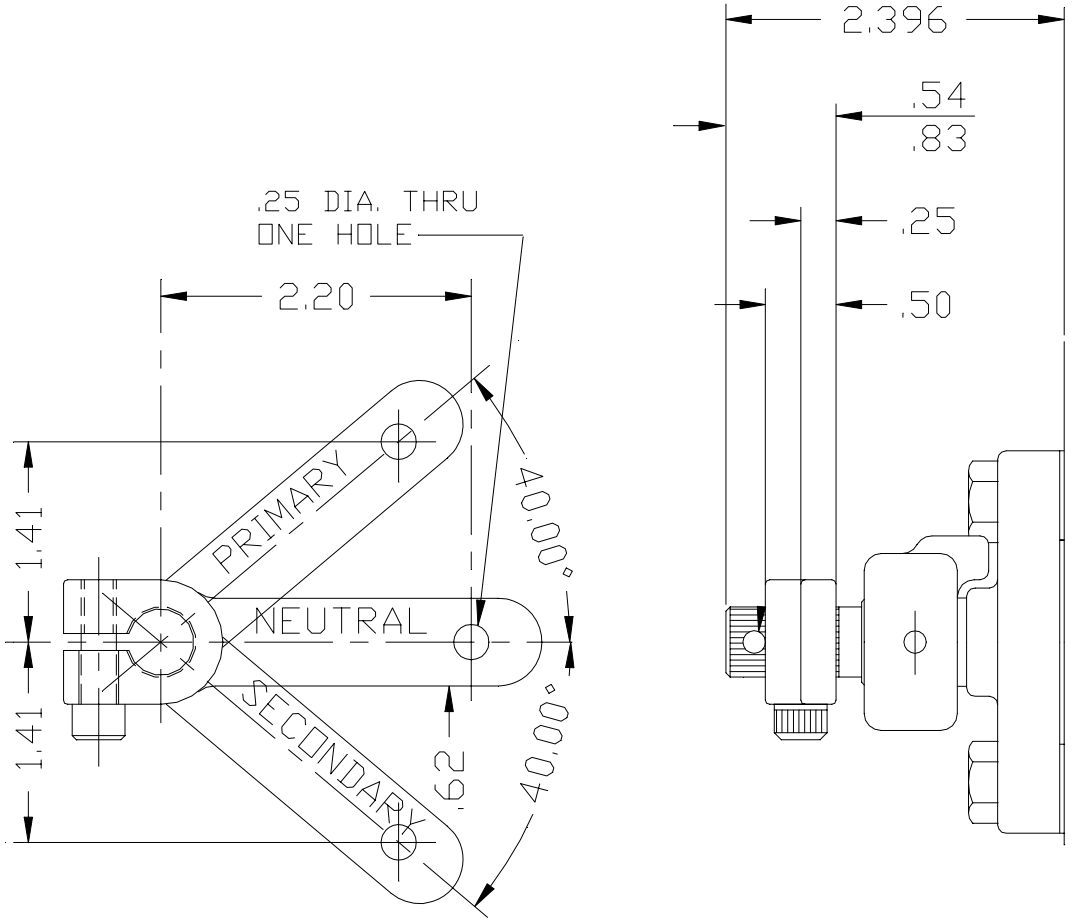


Figure 122. Installation Details Manual Control Linkage

Power Controls

Selector valve positioning devices must be installed so that full travel of the actuating cylinder places the transmission selector valve in the detent position for forward or reverse, as selected, without exerting pressure on the rotational stop collar on the selector valve stem. Selecting neutral must place the selector valve in the neutral detent position. Improper installation of power engaging devices could cause failure of the selector valve rotational stop collar permitting improper positioning of the selector valve and resulting in control malfunction.

Electrical Controls

All electrical wires and connectors must be adequately supported to prevent rubbing or distress from relative movement.

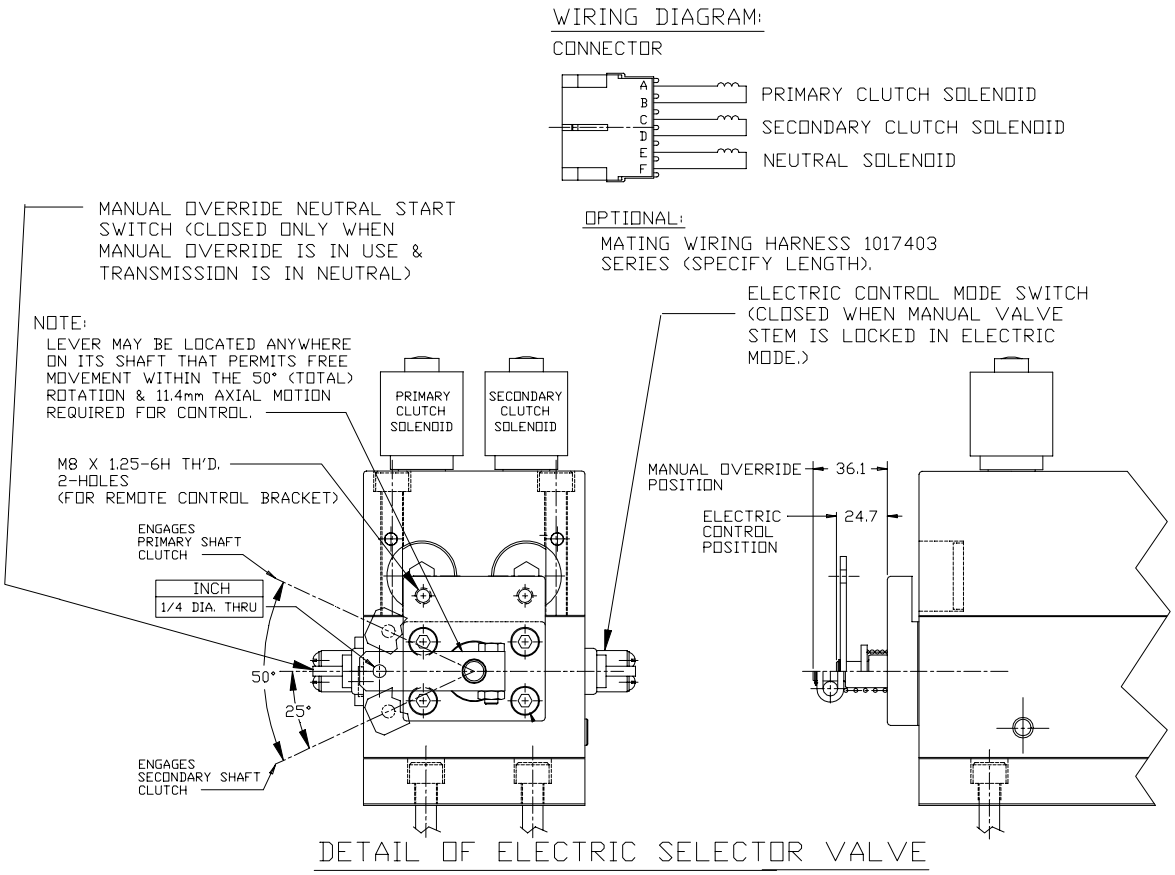

WIRING DIAGRAM:
CONNECTOR
A
B
C
D
E
F
PRIMARY CLUTCH SOLENOID
SECONDARY CLUTCH SOLENOID
NEUTRAL SOLENOID
MANUAL OVERRIDE NEUTRAL START SWITCH (CLOSED ONLY WHEN MANUAL OVERRIDE IS IN USE & TRANSMISSION IS IN NEUTRAL)
OPTIONAL:
MATING WIRING HARNESS 1017403 SERIES (SPECIFY LENGTH).
ELECTRIC CONTROL MODE SWITCH (CLOSED WHEN MANUAL VALVE STEM IS LOCKED IN ELECTRIC MODE.)
NOTE:
LEVER MAY BE LOCATED ANYWHERE ON ITS SHAFT THAT PERMITS FREE MOVEMENT WITHIN THE 50° (TOTAL) ROTATION & 11.4mm AXIAL MOTION REQUIRED FOR CONTROL.
PRIMARY CLUTCH SOLENOID
SECONDARY CLUTCH SOLENOID
M8 X 1.25-6H TH'D. 2-HOLES (FOR REMOTE CONTROL BRACKET)
MANUAL OVERRIDE POSITION
36.1
ELECTRIC CONTROL POSITION
24.7
ENGAGES PRIMARY SHAFT CLUTCH
INCH
1/4 DIA. THRU
50°
25°
ENGAGES SECONDARY SHAFT CLUTCH
DETAIL OF ELECTRIC SELECTOR VALVE

Figure 123. Electric Valve Details

Final Checks

Be sure the transmission is filled with oil before starting. See Description and Specifications and Preventative Maintenance for proper oil and filling procedure.

Special Tools

- ❑ Recommended Pump Set and Fluids
- ❑ T-19987 Gear Lifting Fixture
- ❑ T-19987 Gear Lifting Fixture (detail 1, 2 and 3)
- ❑ T-19987 Gear Assembly Fixture (detail 4)
- ❑ T-19987 Gear Assembly Fixture (detail 5 and 6)
- ❑ T-18050-726 Clutch Pickup Fixture - Primary
- ❑ T-18050-727 Clutch Pickup Fixture - Secondary
- ❑ T-18050-682 Bearing Driver - Caged Roller
- ❑ T-18050-685 Bearing Pick-Up & Driver
- ❑ T-18050-686 Bearing Driver for Cup
- ❑ T-18050-684 Bearing Driver for Outer Race
- ❑ T-18050-687 Bearing Driver - Inner Race
- ❑ T-18050-693 Driver - Seal
- ❑ T-18050-681 Bearing Cone Driver
- ❑ T-18050-689 Bearing Driver
- ❑ T-18050-691 Bearing Driver
- ❑ T-18050-690 Bearing Driver
- ❑ T-18050-694 Spring Hold-Down Retainer
- ❑ T-21413 (1 of 2) Output Flange Fixture
- ❑ T-21413 (2 of 2) Output Flange Fixture
- ❑ T-18050-692 Seal Driver
- ❑ T-18050-683 Bearing Driver for Cone

❑	T-05600	Lifting Tool for Clutch Removal in Boat
❑	T-18050-688 (1 of 2)	Bearing Driver - Cone
❑	T-18050-688(2 of 2)	Bearing Driver - Cone
❑	T-20023 (1 of 6)	Output Gear to Shaft Puller
❑	T-20023 (2 of 6)	Output Gear to Shaft Puller
❑	T-20023 (3 of 6)	Output Gear to Shaft Puller
❑	T-20023 (4 of 6)	Output Gear to Shaft Puller
❑	T-20023 (5 of 6)	Output Gear to Shaft Puller
❑	T-20023 (6 of 6)	Output Gear to Shaft Puller

Recommended Pump Set and Fluids

Twin Disc recommends the following products for use in the assembly and removal of tapered shafts using the oil injection method:

THAP 300 Air-Driven Pump Set

This set consists of the air-driven pump with accessories, such as an adapter block, pressure gauge, high pressure pipe, or pressure hose with quick connection couplings and connection nipples. The set includes one of each: air-driven pump [THAP 300], adapter block [226402], pressure gauge [1077589] and high pressure pipe (2m/6.5 ft.) [227957A].

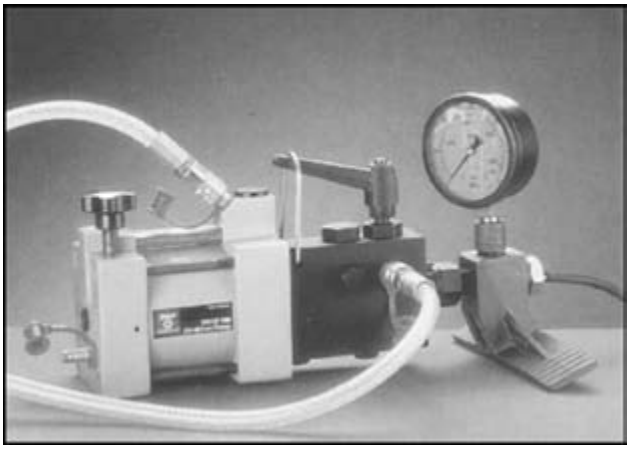


Figure 124. THAP 300 Air-driven Pump Set

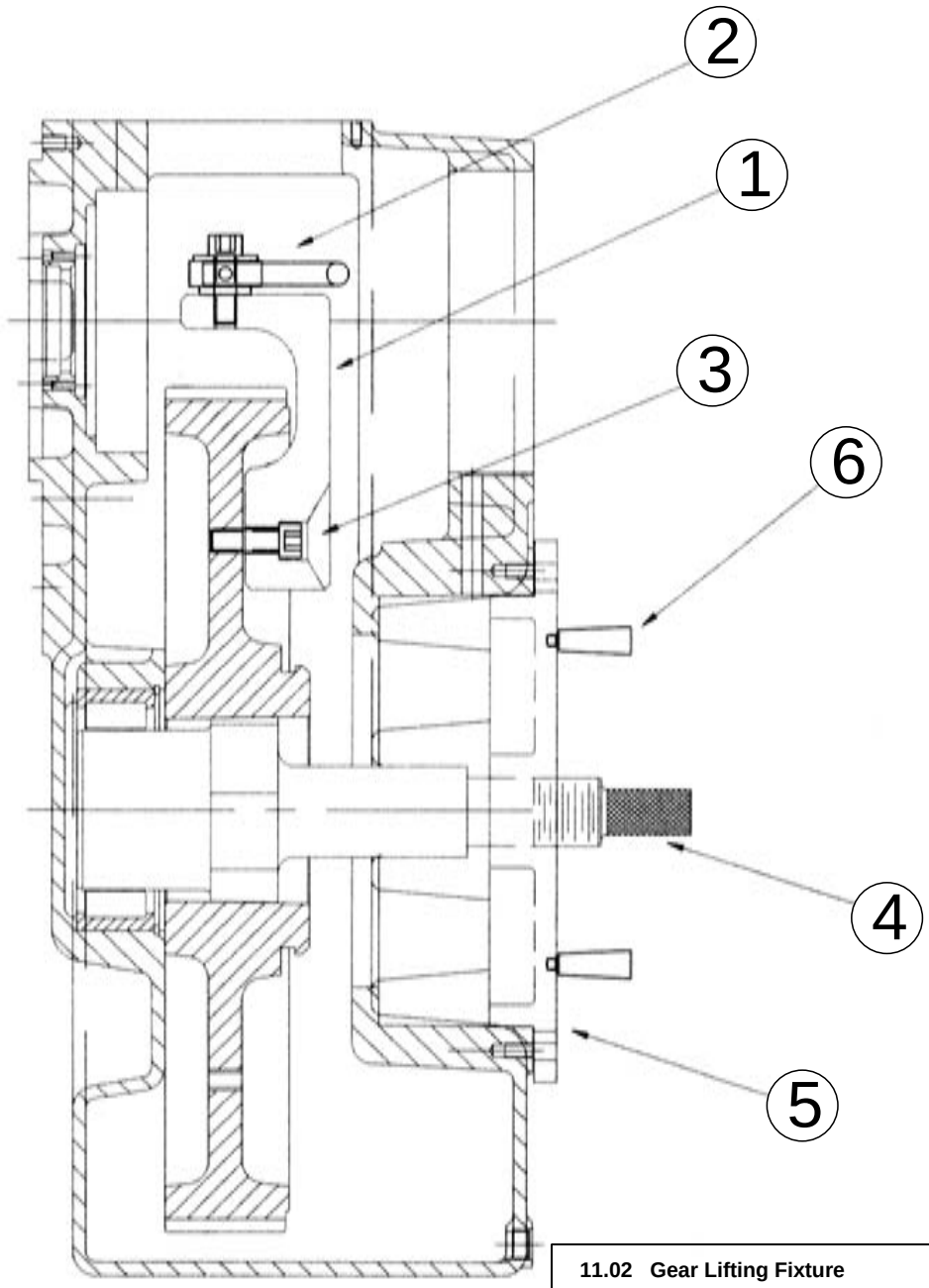
Mounting Fluid LHMF 300 and Dismounting Fluid LHDF 900

SKF LHMF 300 and LHDF 900 are recommended when using SKF hydraulic equipment like hydraulic pumps. HMV nuts, oil injection equipment, etc. The fluids contain anticorrosives and are non-aggressive to seal material like nitrile rubber, Buna N (Perbunan), chrome, leather, PTFE, etc. SKF LHMF 300 and LHDF 900 are available in 5 liter (5.3 qt.) cans. Designation: LHMF 300/5 and LHDF 900/6.

Figure 125. SKF LHMF 300 and LHDF 900

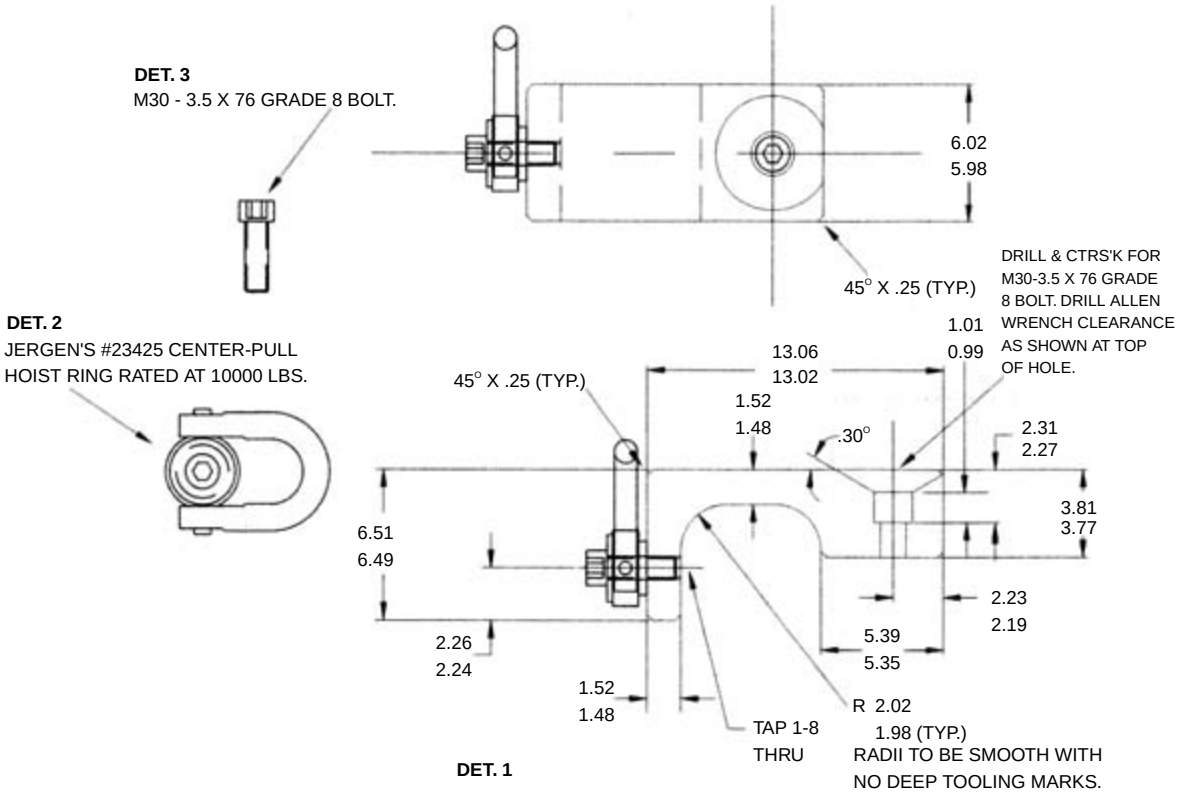
Note: Order Through Your Local Authorized SKF Distributor

T-19987 Gear Lifting Fixture



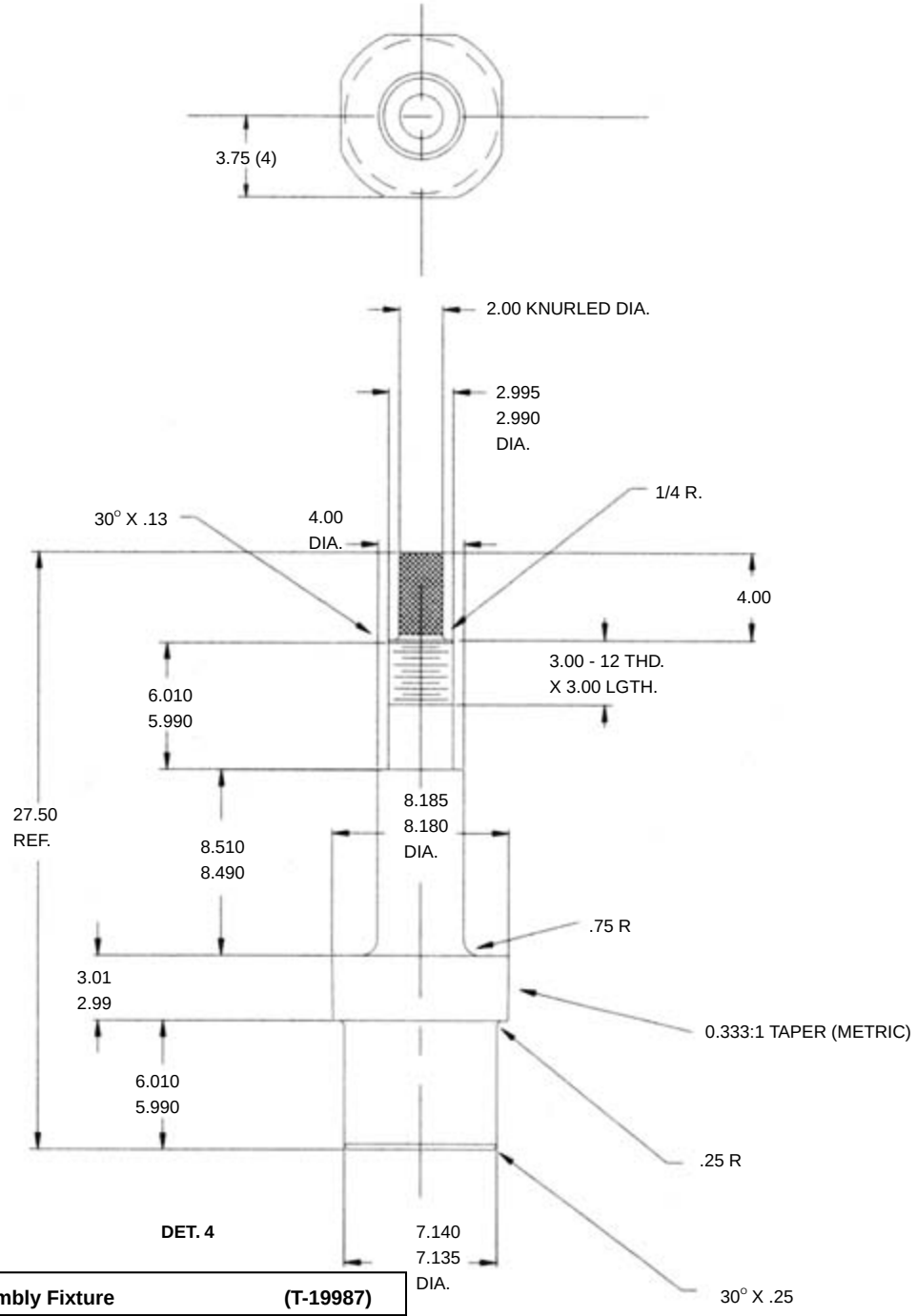
11.02 Gear Lifting Fixture (T-19987)			
DET.	**REQ.**	**MAT.**	**Description & Stock Size**
6	2		Drawing 11.05
5	1		Drawing 11.05
4	1		Drawing 11.04
3	1		Drawing 11.03
2	1		Drawing 11.03
1	1		Drawing 11.03

T-19987 (detail 1, 2 and 3) Gear Lifting Fixture



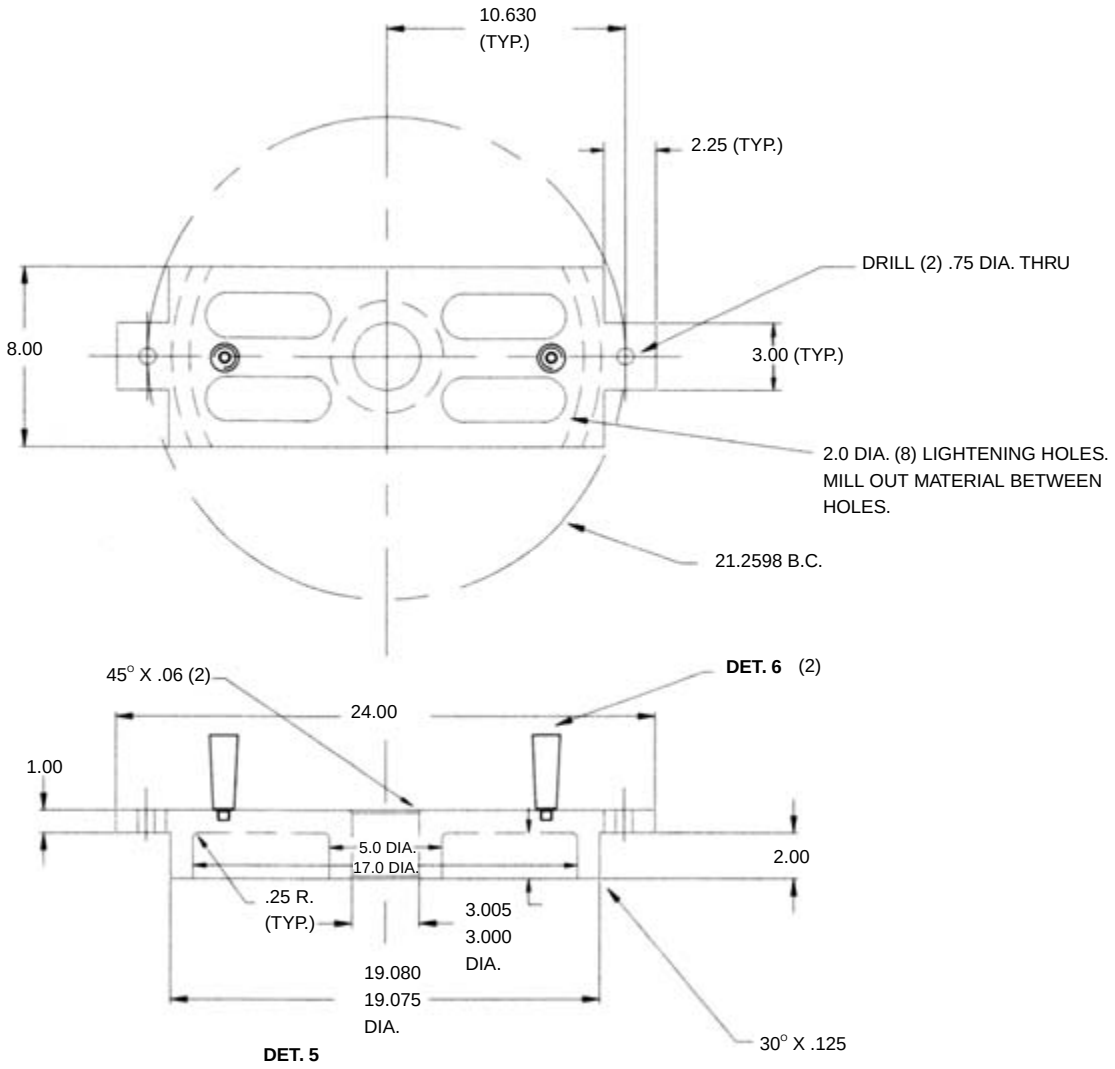
11.03 Gear Lifting Fixture (T-19987)			
DET.	**REQ.**	**MAT.**	**Description & Stock Size**
3	1	PUR.	M30-3.5 X 76 Grade 8 socket head bolt
2	1	PUR.	Jergen's #23425 Lifting Ring
1	1	4140	Block Rc 32-36, any spot 13.5 x 7.0 x 6.5

T-19987 (detail 4) Gear Assembly Fixture



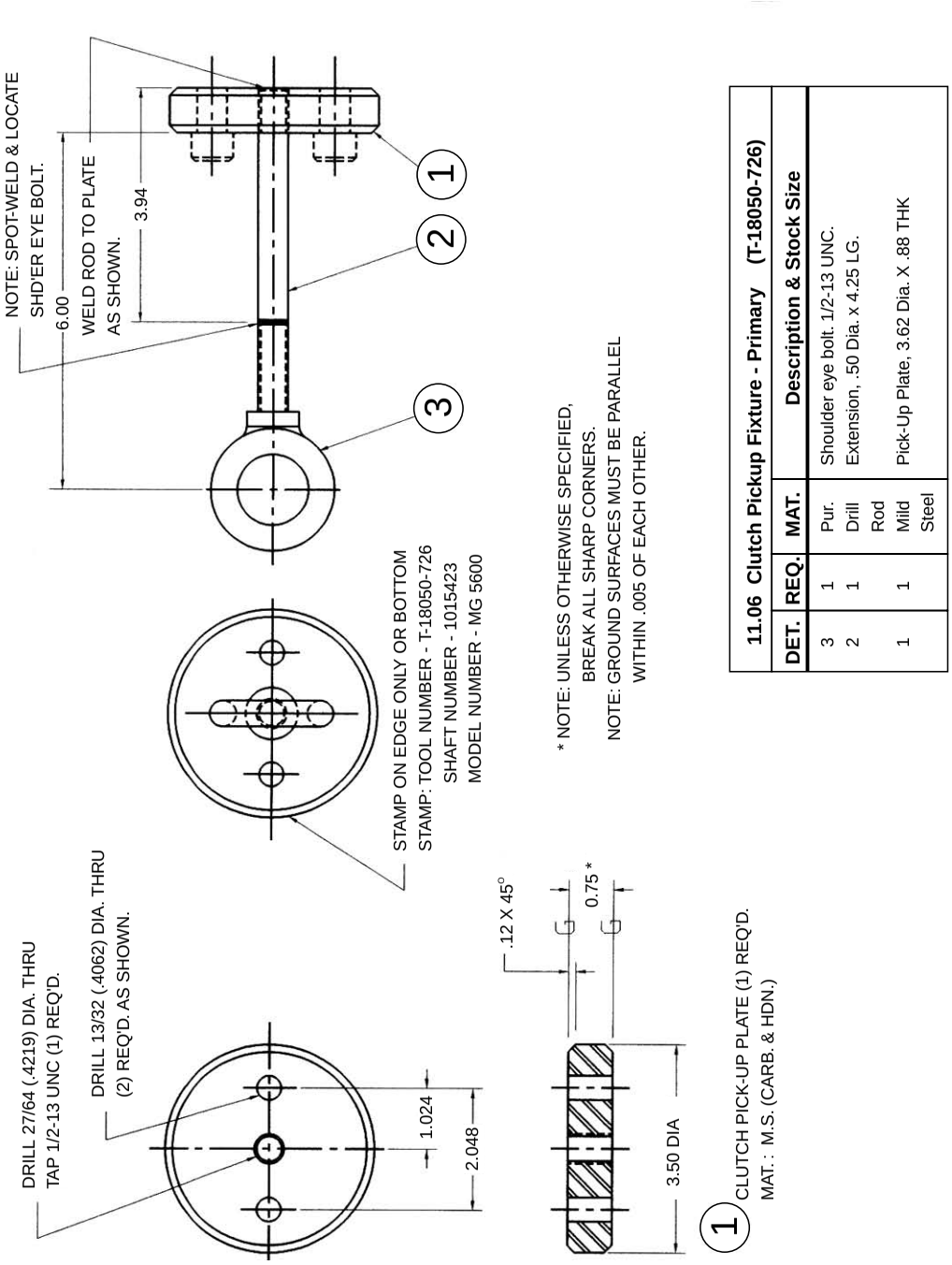
11.04 Gear Assembly Fixture (T-19987)			
DET.	**REQ.**	**MAT.**	**Description & Stock Size**
4	1	UHMW-PE	Alligning shaft. Pur. Comp. Kitco Plastics

T-19987 (detail 5 and 6) Gear Assembly Fixture



11.05 Gear Assembly Fixture (T-19987)			
DET.	**REQ.**	**MAT.**	**Description & Stock Size**
6	2	PUR.	Jergens #21906 handle
5	1	4140	Alligning plate Rc 32-36, 24.5 x 8.5 x 3.5

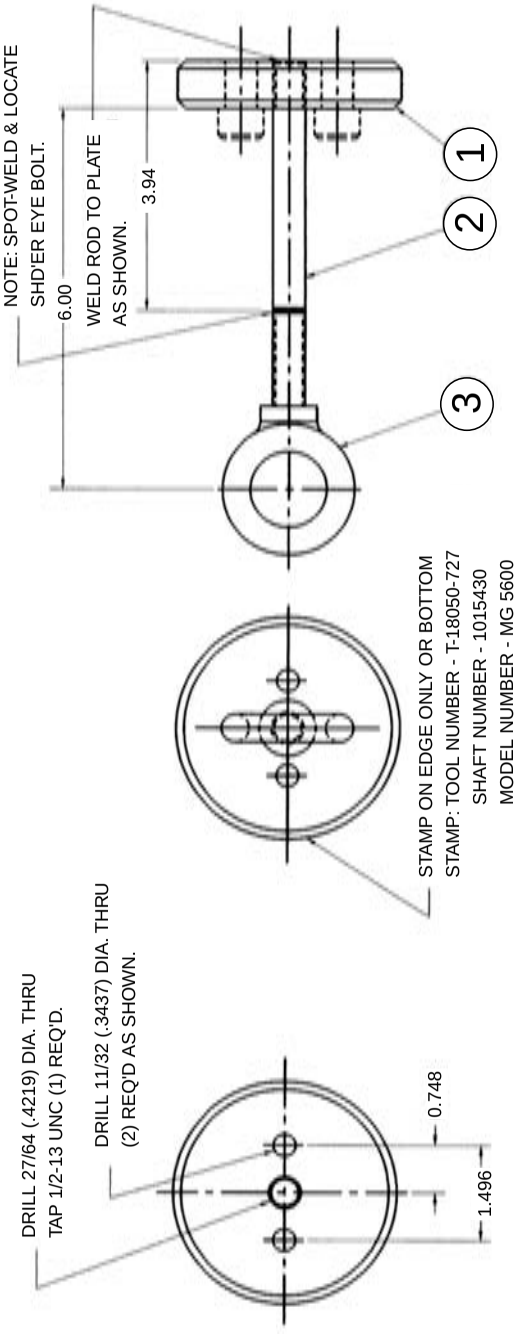
T-18050-726 Clutch Pickup Fixture - Primary


NOTE: SPOT-WELD & LOCATE SHD'ER EYE BOLT.
6.00
WELD ROD TO PLATE AS SHOWN.
3.94
1
2
3
STAMP ON EDGE ONLY OR BOTTOM
STAMP: TOOL NUMBER - T-18050-726
SHAFT NUMBER - 1015423
MODEL NUMBER - MG 5600
* NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.
NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .005 OF EACH OTHER.
DRILL 27/64 (.4219) DIA. THRU
TAP 1/2-13 UNC (1) REQ'D.
DRILL 13/32 (.4062) DIA. THRU (2) REQ'D. AS SHOWN.
1.024
2.048
.12 X 45°
0.75 *
3.50 DIA
1 CLUTCH PICK-UP PLATE (1) REQ'D.
MAT.: M.S. (CARB. & HDN.)

11.06 Clutch Pickup Fixture - Primary (T-18050-726)

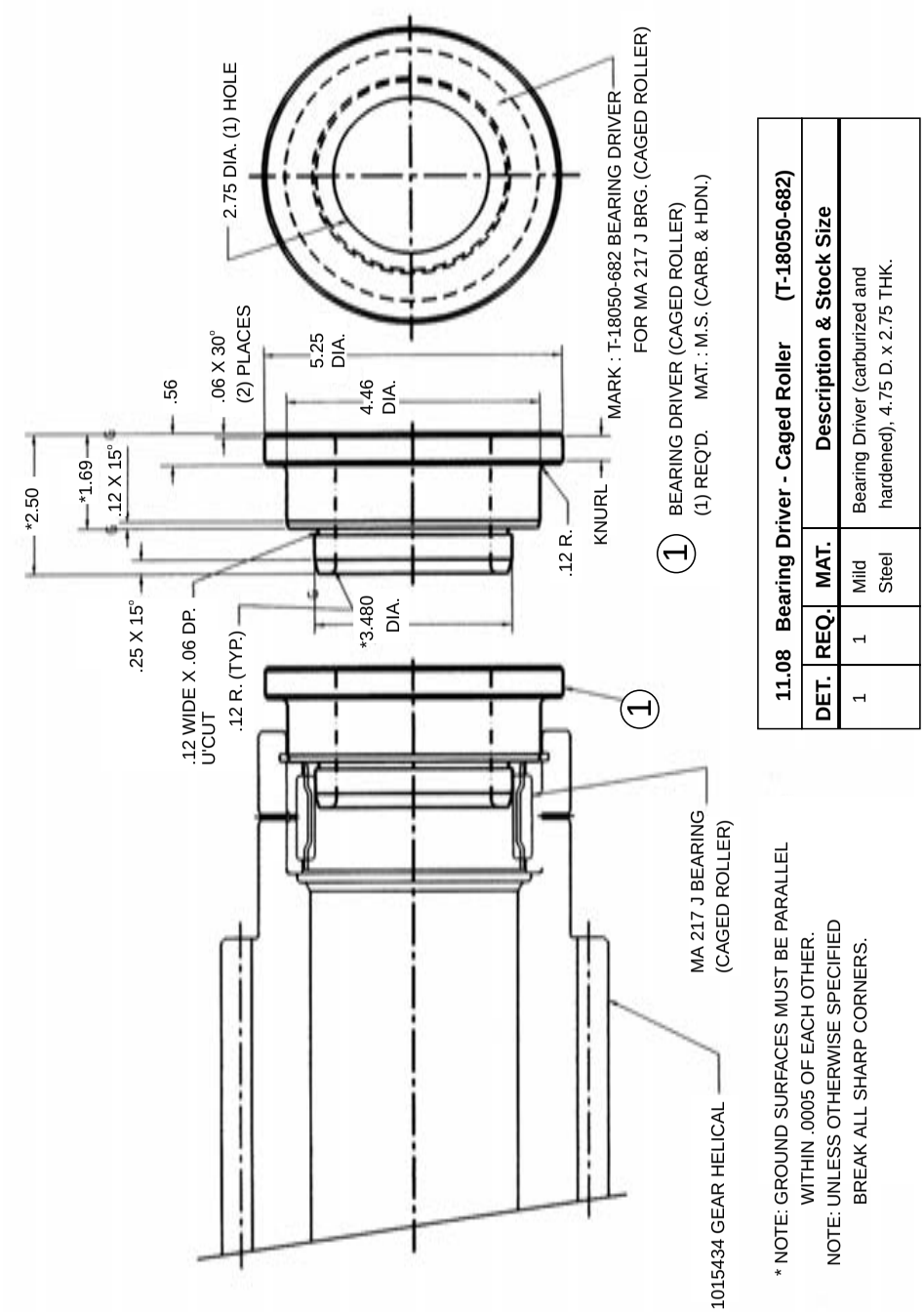
DET.	REQ.	MAT.	Description & Stock Size
3	1	Pur.	Shoulder eye bolt. 1/2-13 UNC.
2	1	Drill Rod	Extension, .50 Dia. x 4.25 LG.
1	1	Mild Steel	Pick-Up Plate, 3.62 Dia. X .88 THK

T-18050-727 Clutch Pickup Fixture - Secondary


NOTE: SPOT-WELD & LOCATE SHD'ER EYE BOLT.
6.00
WELD ROD TO PLATE AS SHOWN.
3.94
1
2
3
STAMP ON EDGE ONLY OR BOTTOM
STAMP: TOOL NUMBER - T-18050-727
SHAFT NUMBER - 1015430
MODEL NUMBER - MG 5600
DRILL 27/64 (.4219) DIA. THRU
TAP 1/2-13 UNC (1) REQ'D.
DRILL 11/32 (.3437) DIA. THRU
(2) REQ'D AS SHOWN.
0.748
1.496
.12 X 45°
0.75 *
3.50 DIA
1 CLUTCH PICK-UP PLATE (1) REQ'D.
MAT.: M.S. (CARB. & HDN.)
* NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.
NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .005 OF EACH OTHER.

11.07 Clutch Pickup Fixture - Secondary (T-18050-727)			
DET.	REQ.	MAT.	Description & Stock Size
3	1	Pur.	Shoulder eye bolt. 1/2-13 UNC.
2	1	Drill Rod	Extension, .50 Dia. x 4.25 LG.
1	1	Mild Steel	Pick-Up Plate, 3.62 Dia. X .88 THK.

T-18050-682 Bearing Driver - Caged Roller

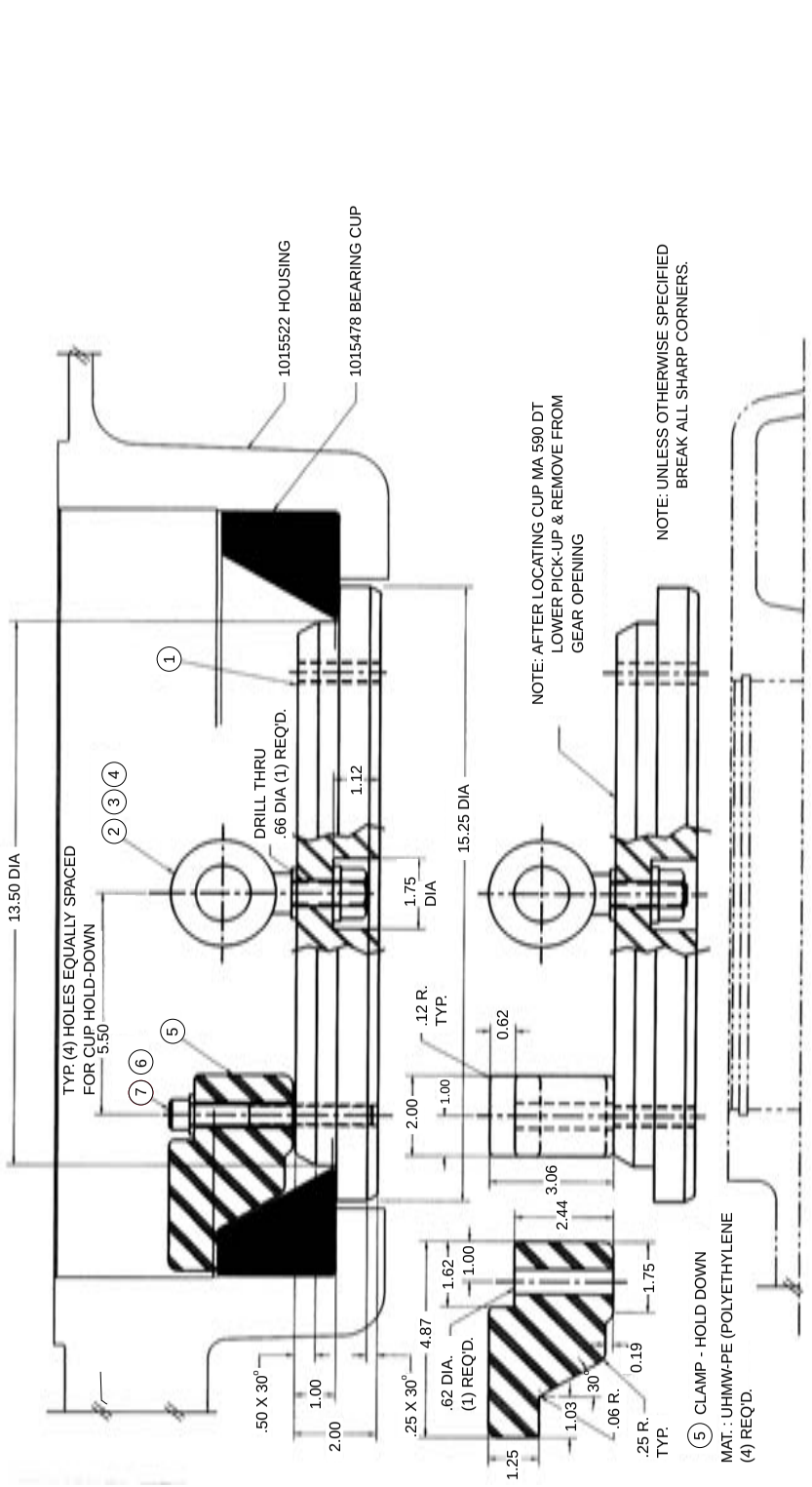


11.08 Bearing Driver - Caged Roller (T-18050-682)			
DET.	REQ.	MAT.	Description & Stock Size
1	1	Mild Steel	Bearing Driver (carburized and hardened), 4.75 D. x 2.75 THK.

* NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER.

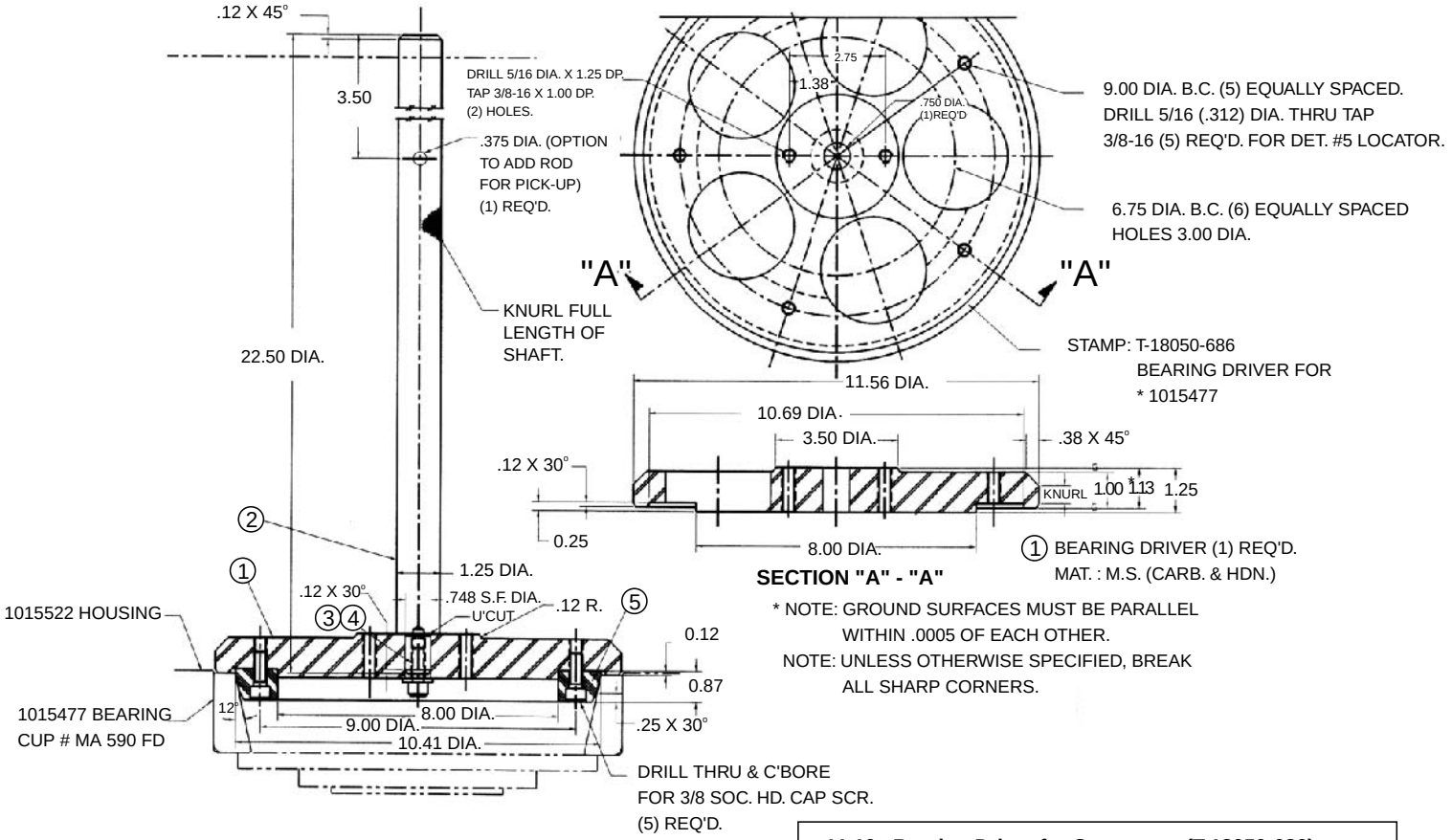
NOTE: UNLESS OTHERWISE SPECIFIED BREAK ALL SHARP CORNERS.

T-18050-685 Bearing Pick-Up and Driver



11.09 Bearing Pick-Up & Driver (T-18050-685)			
DET.	REQ.	MAT.	Description & Stock Size
7	1		Flat Washer, FOR 1/2 S.H.C. SCR.
6	1		SOC. HD. Cap Screw, 1/2-13 x 4.5 LG.
5	1	PUR.	Clamp - Hold Down (Kitco), 2.0 W x 3.5 H. x 5.0 LG.
4	1		Jergens Flanged Nut, #19907
3	1		Jergens Flat Washer, #32006
2	1		Jergens Shoulder Bolt, #18505
1	1	POLY.	Base - Pick-Up, 15.5 DIA. x 2.00 TK.

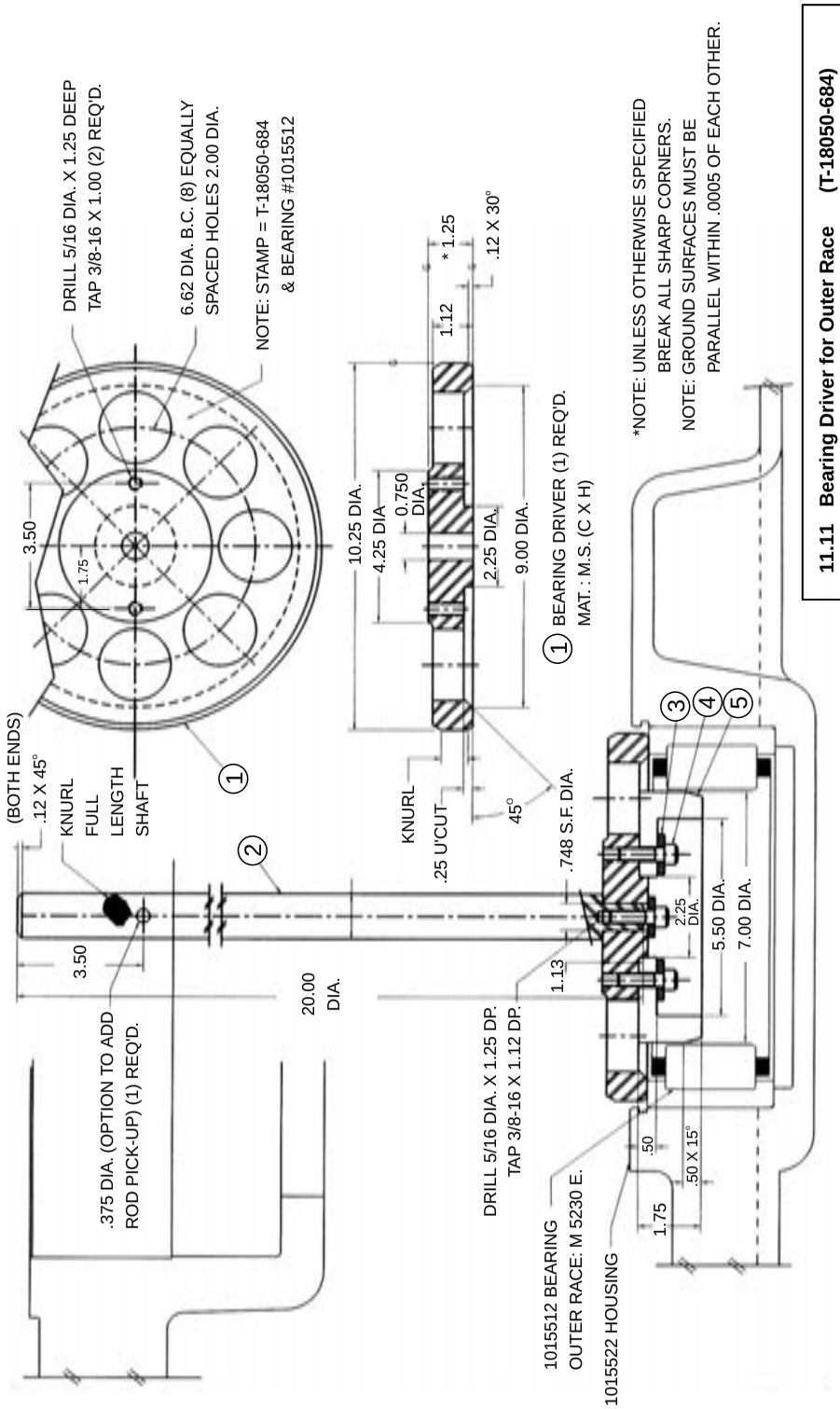
T-18050-686 Bearing Driver for Cup



11.10 Bearing Driver for Cup (T-18050-686)

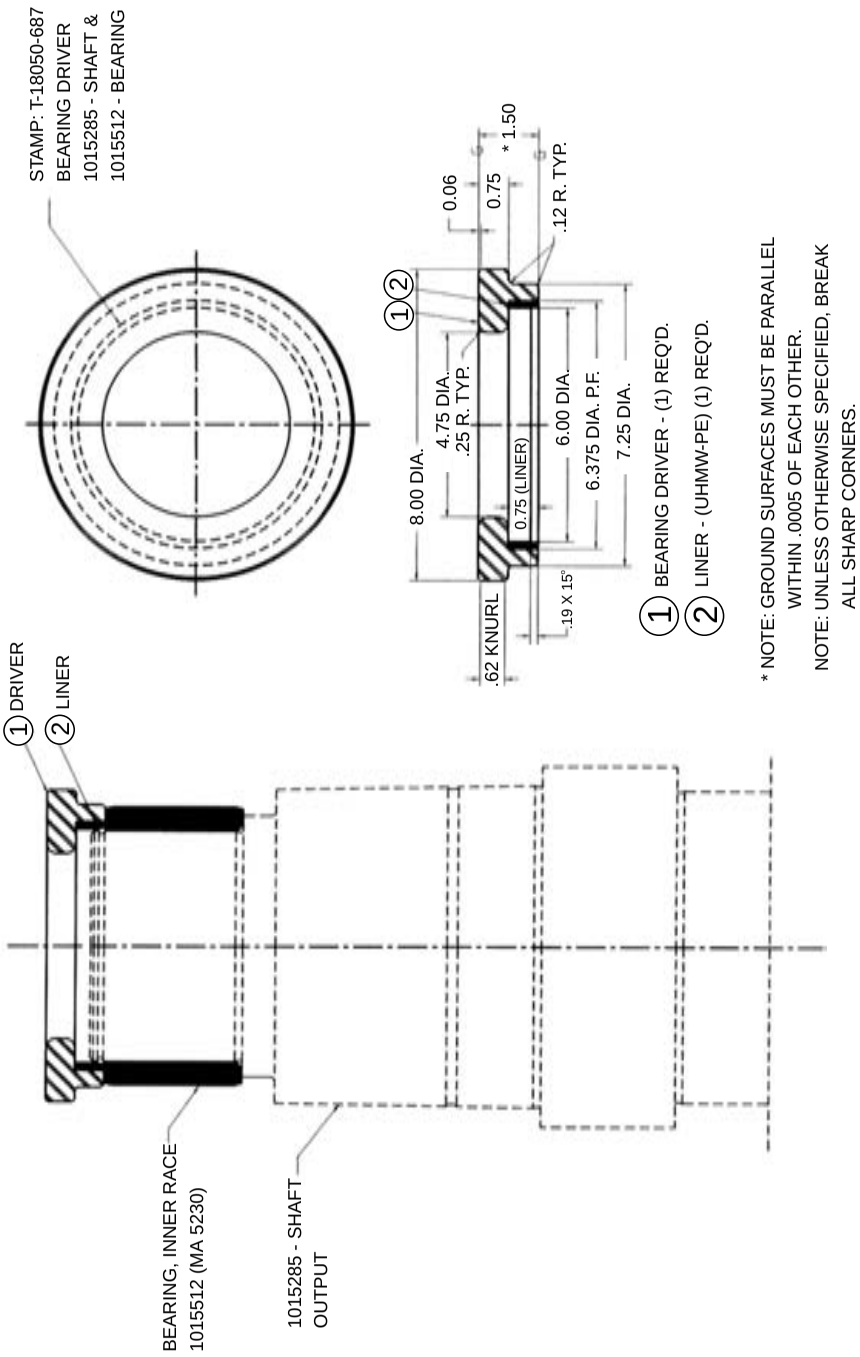
DET.	REQ.	MAT.	Description & Stock Size
5	1	PUR.	Locator Poly. (Kitco), 10.5 Dia. x 1.00 THK.
4	1		Jergens Washer, #32004
3	1		SOC. HD. CAP SCR., 3/8-16 x 1.00 LG.
2	1	ROD	Handle, 1.25 DIA. x 22.75 LG.
1	1	Mild Steel.	Bearing Driver (carburized and hardened) 12.0 Dia. x 2.0 THK.

T-18050-684 Bearing Driver for Outer Race



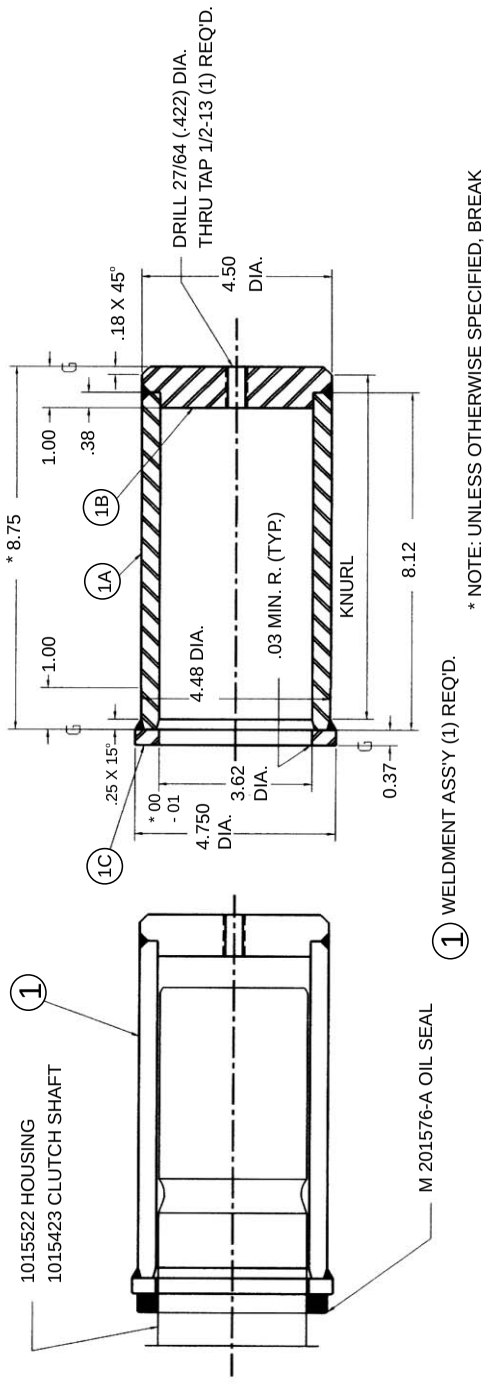
11.11 Bearing Driver for Outer Race (T-18050-684)			
DET.	REQ.	MAT.	Description & Stock Size
5	1	POLY.	Locator - Guide, 7.0 Dia. x 1.75 THK.
4	3		SOC. HD. CAP Scr., 3/8-16 x 1.25 LG.
3	3		Washer, 1.12 Dia. x 40 I.D. x 18 THK.
2	1	ROD	Handle, 1.25 Dia. x 20.5 LG.
1	1	Mild Steel	Bearing Driver (carburized and hardened) 10.5 Dia. x 1.50 THK.

T-18050-687 Bearing Driver for Inner Race



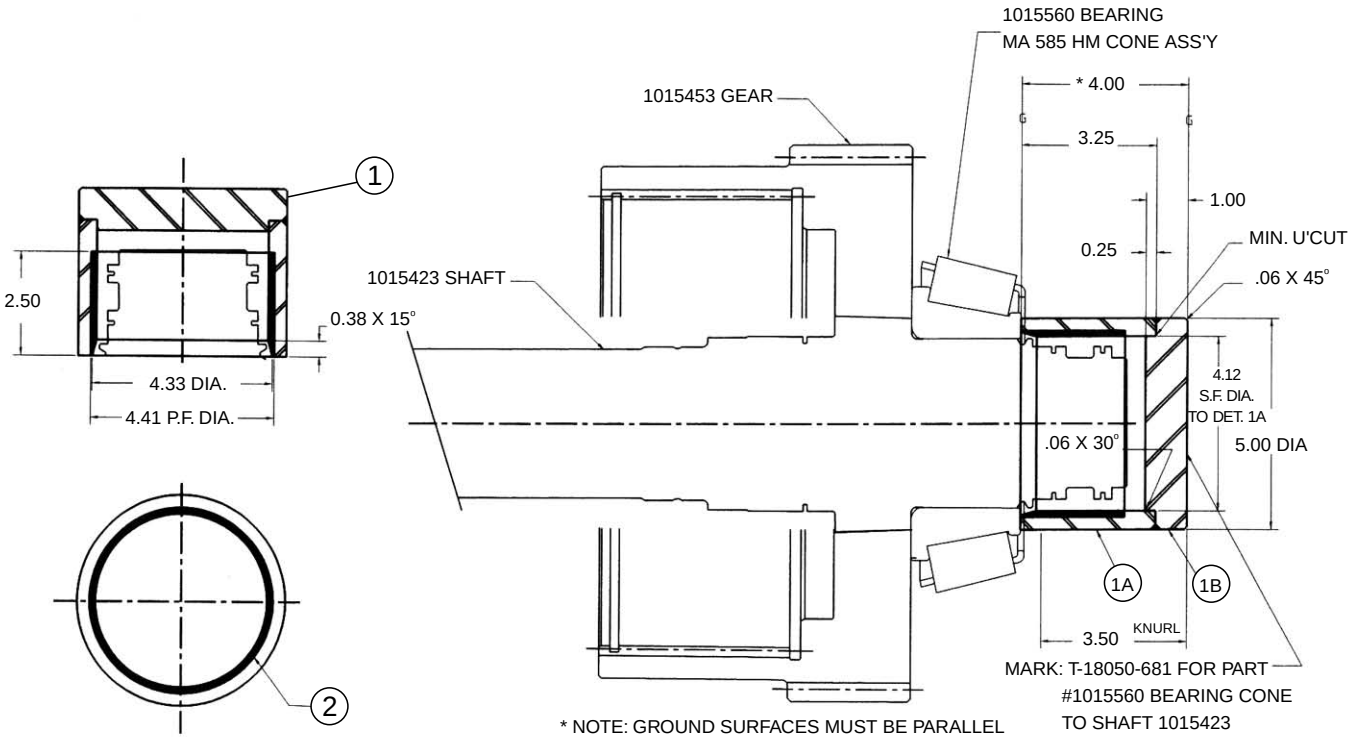
11.12 Bearing Driver - Inner Race (T-18050-687)			
DET.	REQ.	MAT.	Description & Stock Size
2	1	PUR.	Liner (UHMW-PE), Poly. (Kitco) 6.50 Dia. x 7/8 THK.
1	1	Mild Steel	Bearing Driver (carburized and hardened), 8.00 Dia. x 1.75 THK

T-18050-693 Driver - Seal



11.13 Driver - Seal (T-18050-693)			
DET.	REQ.	MAT.	Description & Stock Size
1C	1	Mild Steel	Base Plate (carburized and hardened), 3.00 Dia. x .38 THK.
1B	1	Mild Steel	Cap (carburized and hardened), 4.50 Dia. x 1.0 THK.
1A	1	Mild Steel	Tube - Body (carburized and hardened), 4.50 O.D. x 1.00 WALL x 8.5 LG.
1	1		Weldment Ass'y.

T-18050-681 Bearing Cone Driver



VIEW OF DRIVER SHOWING DET. 2 DELIN SLEEVE FOR SHAFT PROTECTION WHEN PRESSING BEARING CONE ON SHAFT.

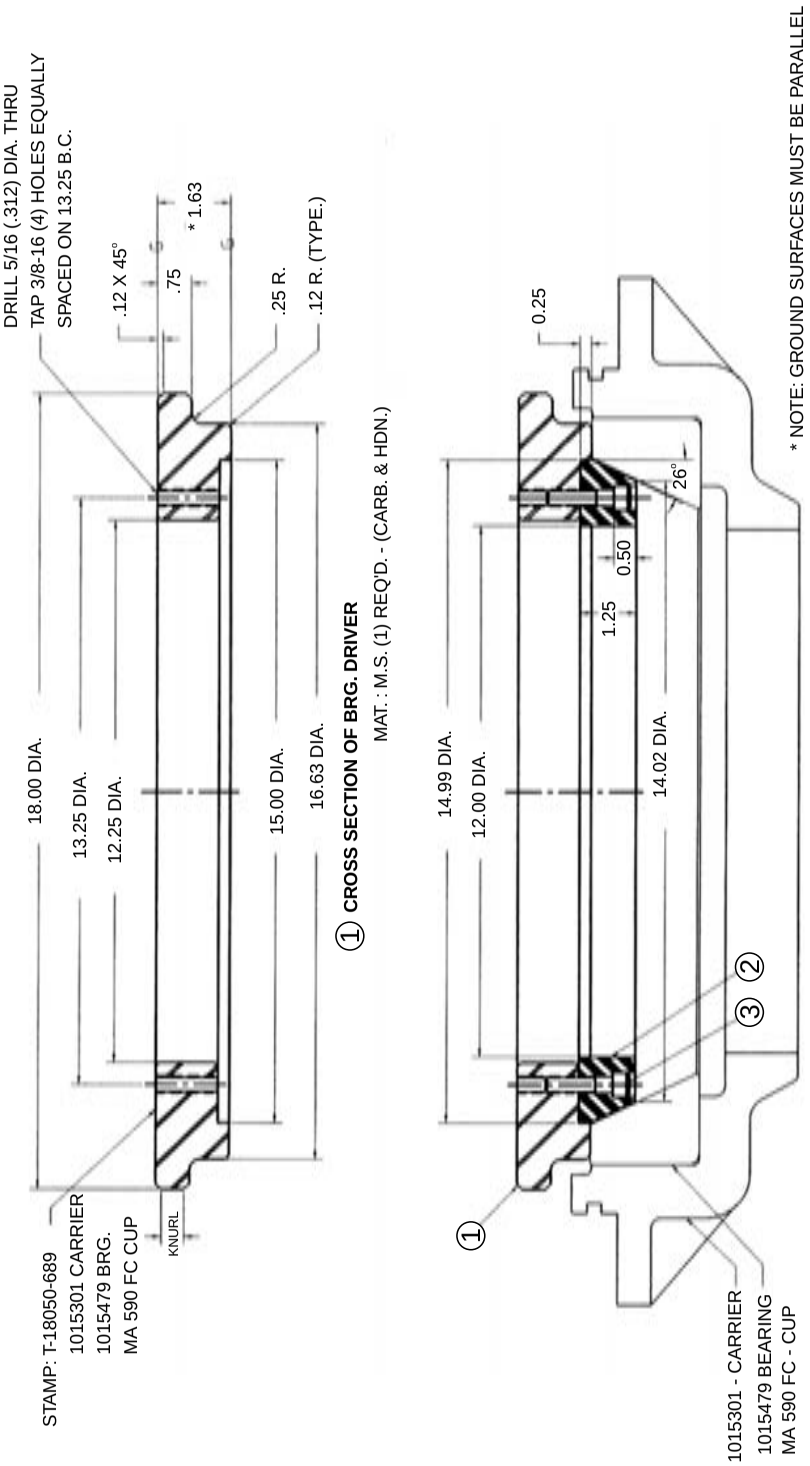
* NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER.

NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.

11.14 Bearing Cone Driver (T-18050-681)

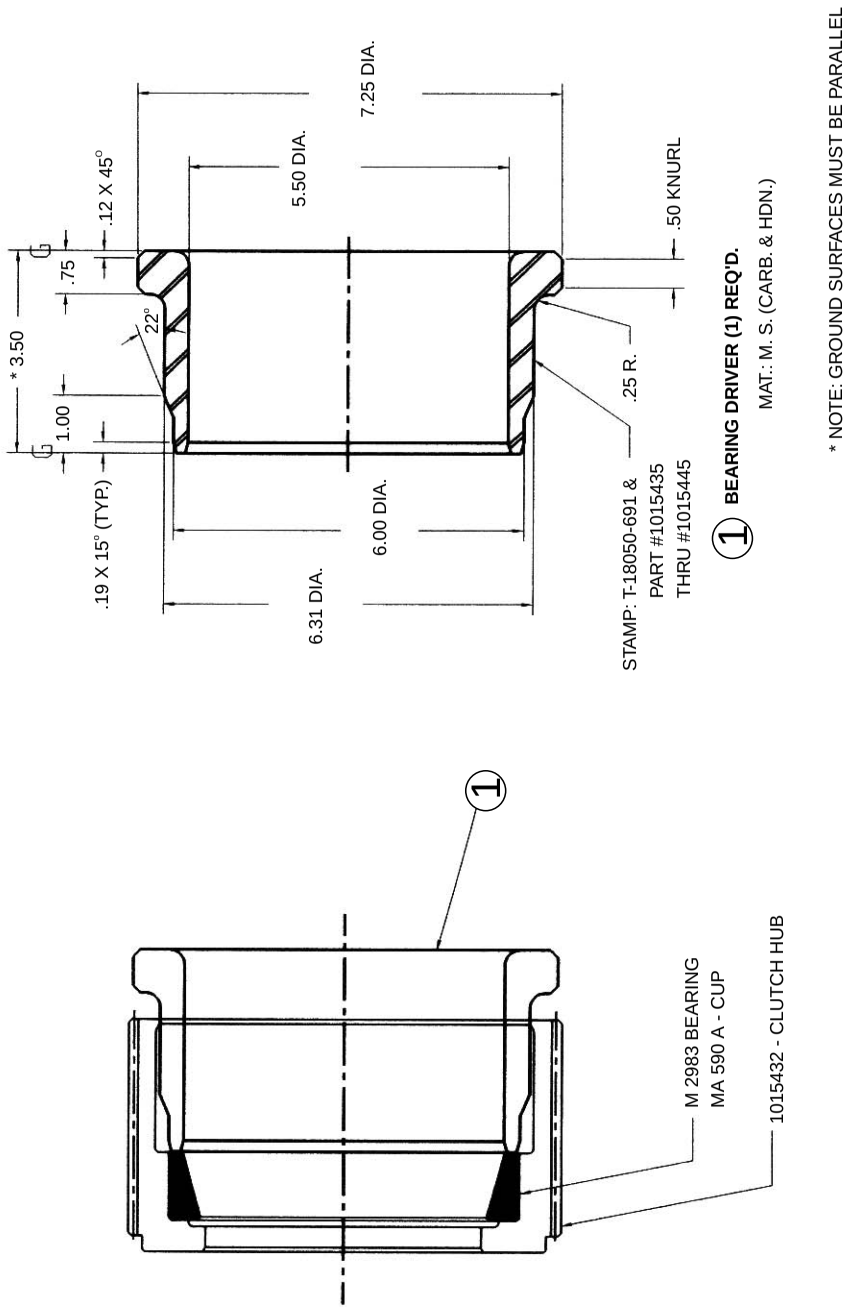
DET.	REQ.	MAT.	Description & Stock Size
2	1	PUR.	Sleeve Delrin or Equiv., 4.50 Dia. x 2.75 LG.
1B	1	Mild Steel	Cap (carburized & hardened), 5.0 Dia. x 1.25 LG.
1A	1	Steel Tube	Body - Tube (carburized & hardened), 5.0 OD x 4.12 ID x 3.5 LG.
1	1		Weldment

T-18050-689 Bearing Driver



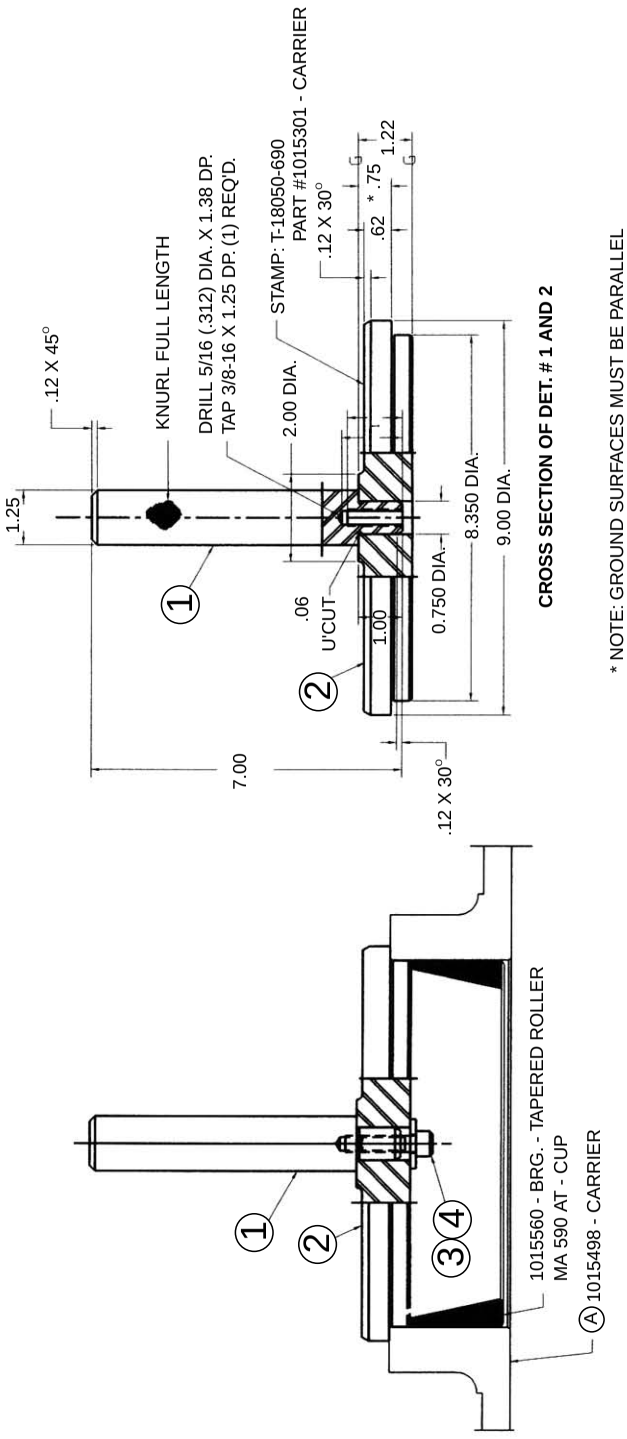
11.15 Bearing Driver (T-18050-689)			
DET.	REQ.	MAT.	Description & Stock Size
3	4		SOC. HD. CAP SCR., 3/8-16 x 1.5 LG.
2	1	PUR.	Brg. Driver Locator, (Kitco) Poly,, 15.25 Dia. x 1.25 THK.
1	1	Mild Steel	Bearing Driver (carburized and hardened) 19.0 Dia. x 1.25 THK.

T-18050-691 Bearing Driver



11.16 Bearing Driver (T-18050-691)			
DET.	REQ.	MAT.	Description & Stock Size
1	1	Mild Steel	Bearing Driver, 7.25 Dia. x 1.0 WALL x 4 THK.

T-18050-690 Bearing Driver



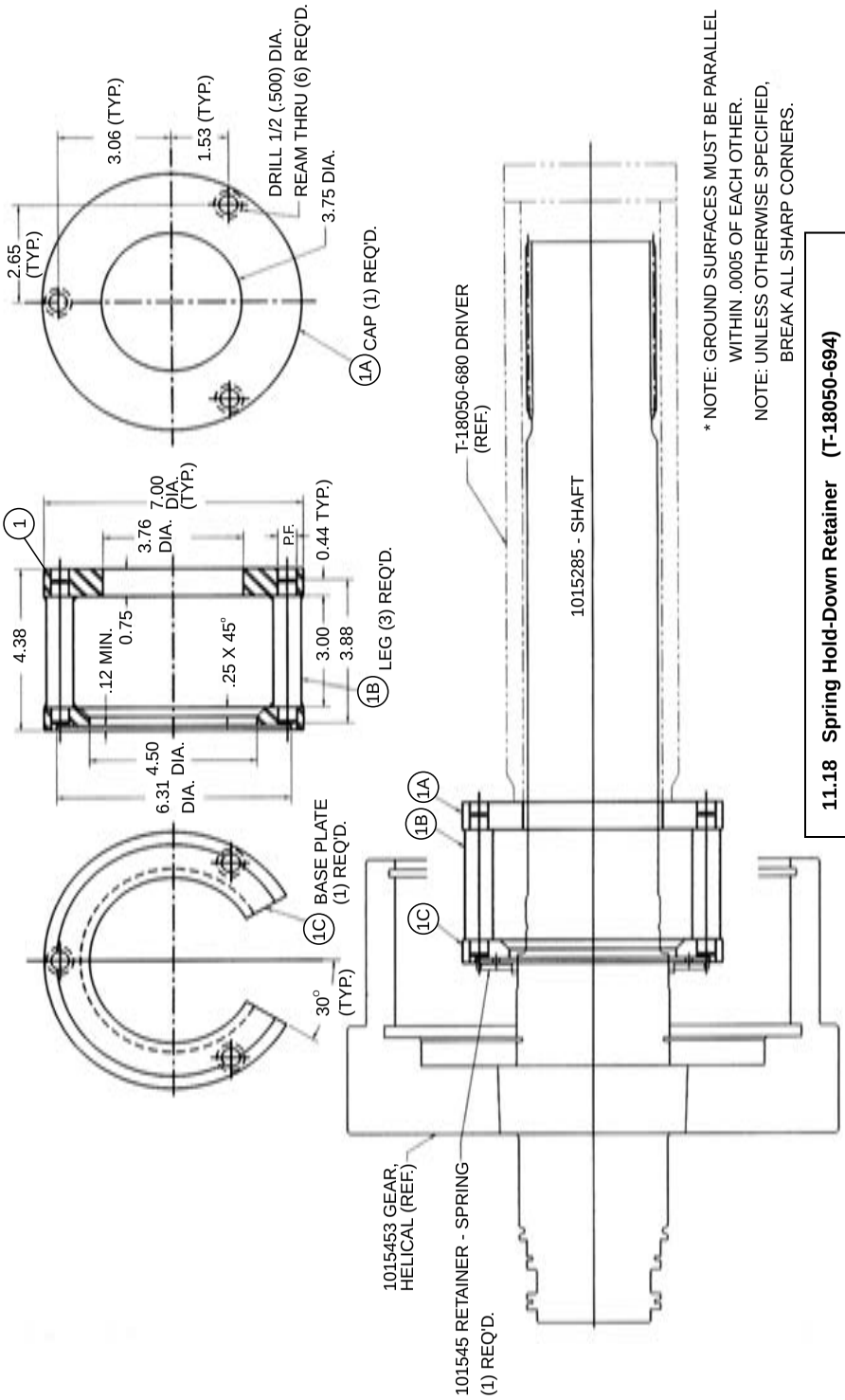
CROSS SECTION OF DET. # 1 AND 2

* NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER.

NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.

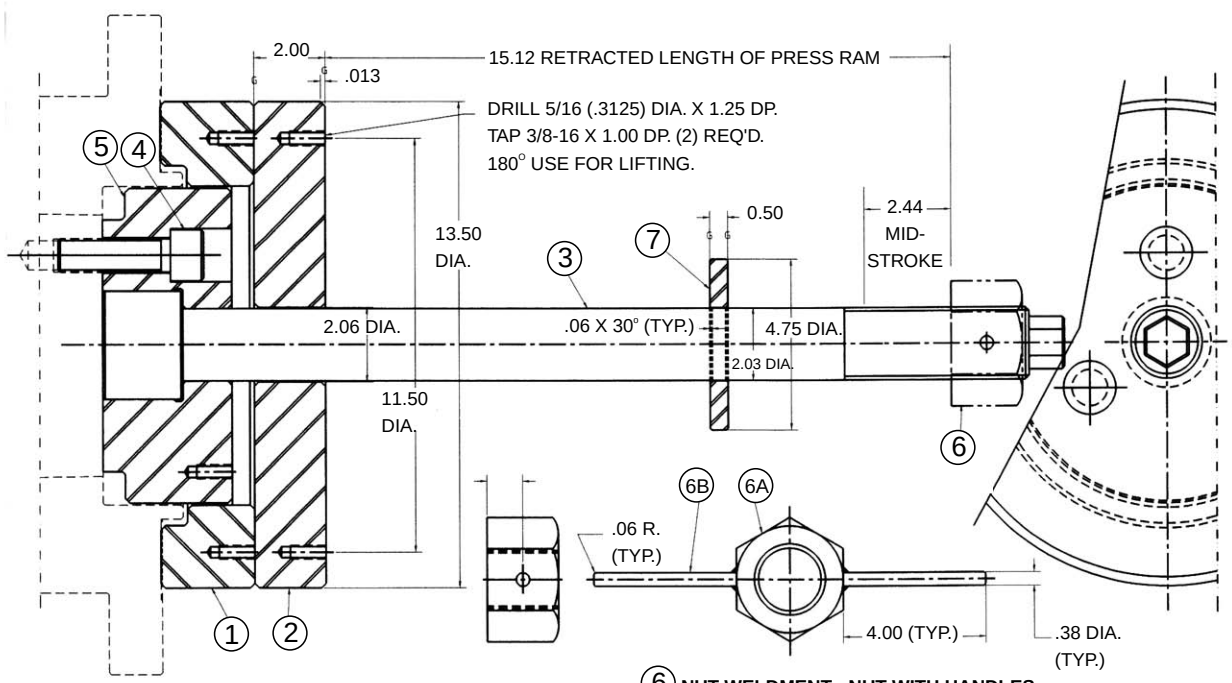
11.17 Bearing Driver (T-18050-690)			
DET.	REQ.	MAT.	Description & Stock Size
4	1		Flat Washer to suit
3	1		SOC. HD. CAP SCR., 9/8-16 x 1.5 LG.
2	1	Drill Rod	Handle, 1.25 Dia. x 7.25 LG.
1	1	Mild Steel	Driver - Base, 8.25 Dia. x 1.50 THK.

T-18050-694 Spring Hold-Down Retainer



11.18 Spring Hold-Down Retainer (T-18050-694)			
DET.	REQ.	MAT.	Description & Stock Size
1C	1	Mild Steel	Base Plate (carburized and hardened)
1B	3	Drill Rod	Leg, 3/4 Dia. x 4.0 LG.
1A	1	Mild Steel	CAP (carburized and hardened)
1	1		Weldment

T-21413 (1 of 2) Output Flange Fixture



6 NUT WELDMENT - NUT WITH HANDLES

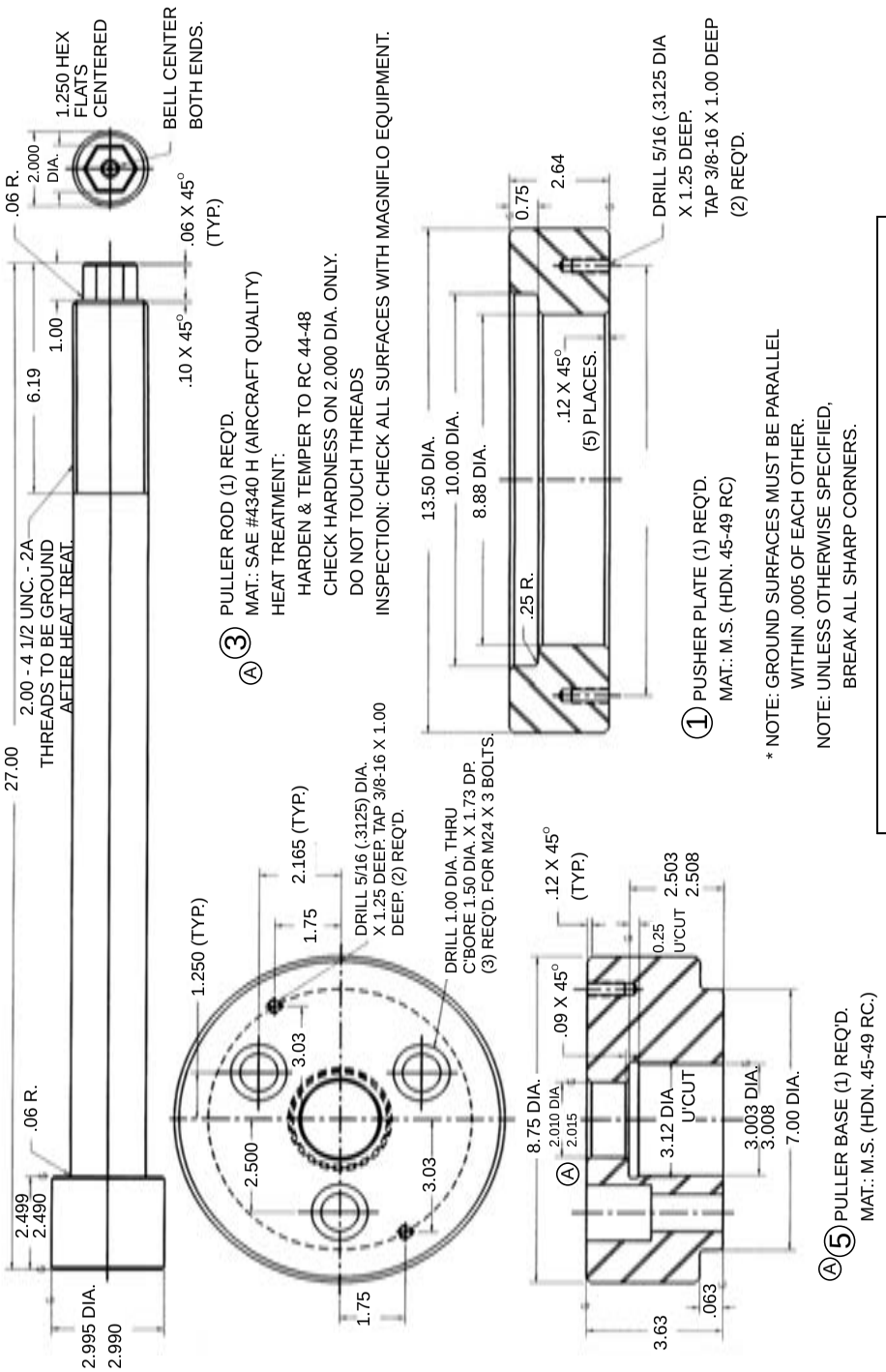
THREAD SIZE: 2 - 4 1/2 UNC. GRADE 8
A 194 GRADE 2H - HEAVY HEX - FULL NUT.

11.19 Output Flange Fixture (T-21413 1 of 2)

DET.	REQ.	MAT.	Description & Stock Size
6B	2	Tool Steel	ROD, 38 x 4.12 LG.
6A	1		Nut, 2.00 x 4-1/2 UNC.
6	1		Weldment
5	1	Mild Steel	(A) Puller Base
4	3		SOC. HD. CAP SCREW, M24 x 3 x 80 mm LG.
3	1	4340H	(A) Puller Rod
2	1	Mild Steel	(A) Plate - Ran Base, 13-5/8 Dia. x 2-1/4 THK.
1	1	Mild Steel	Pusher Plate

* NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER.
NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.

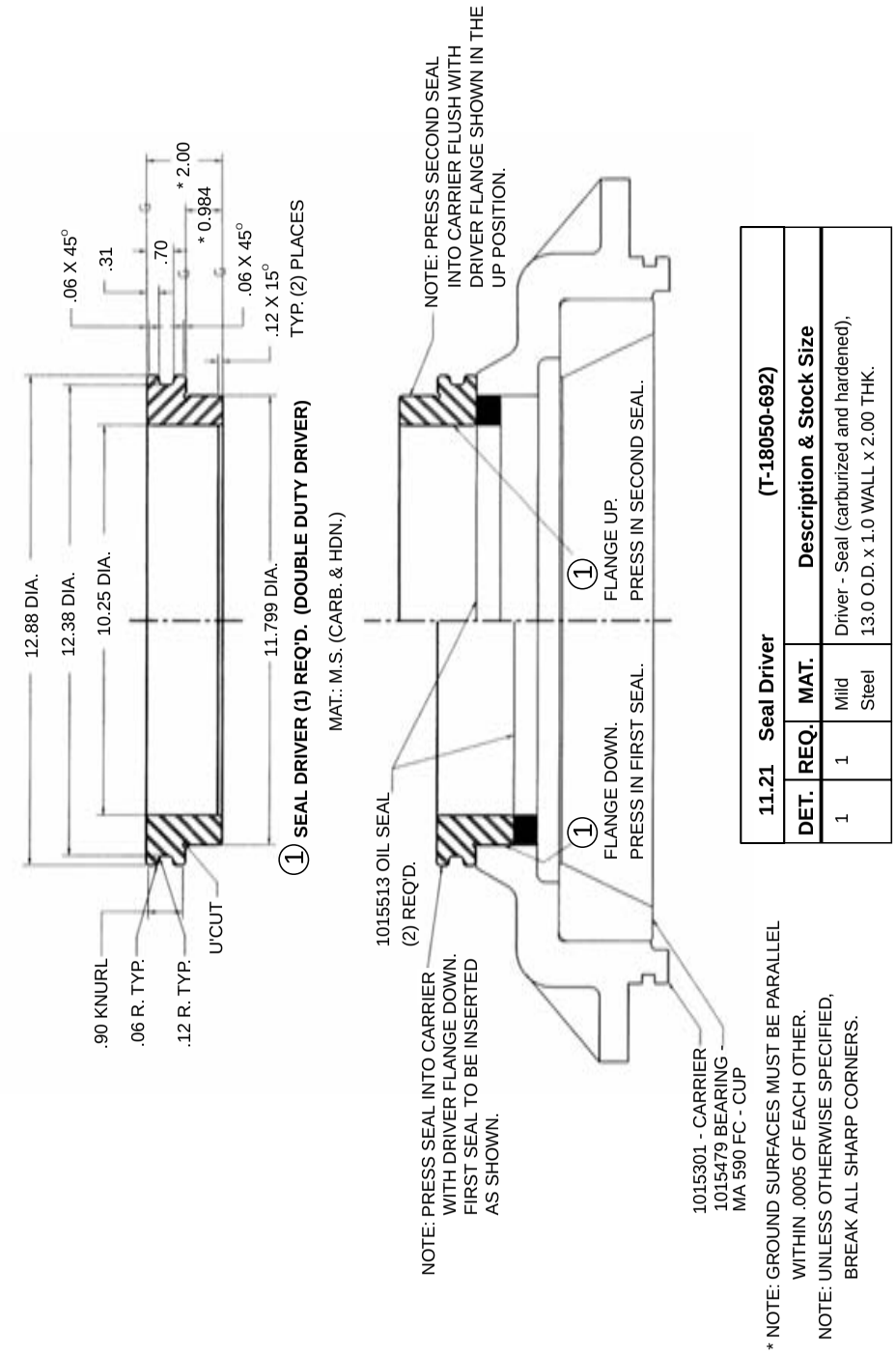
T-21413 (2 of 2) Output Flange Fixture



11.20 Output Flange Fixture (T-21413 2 of 2)

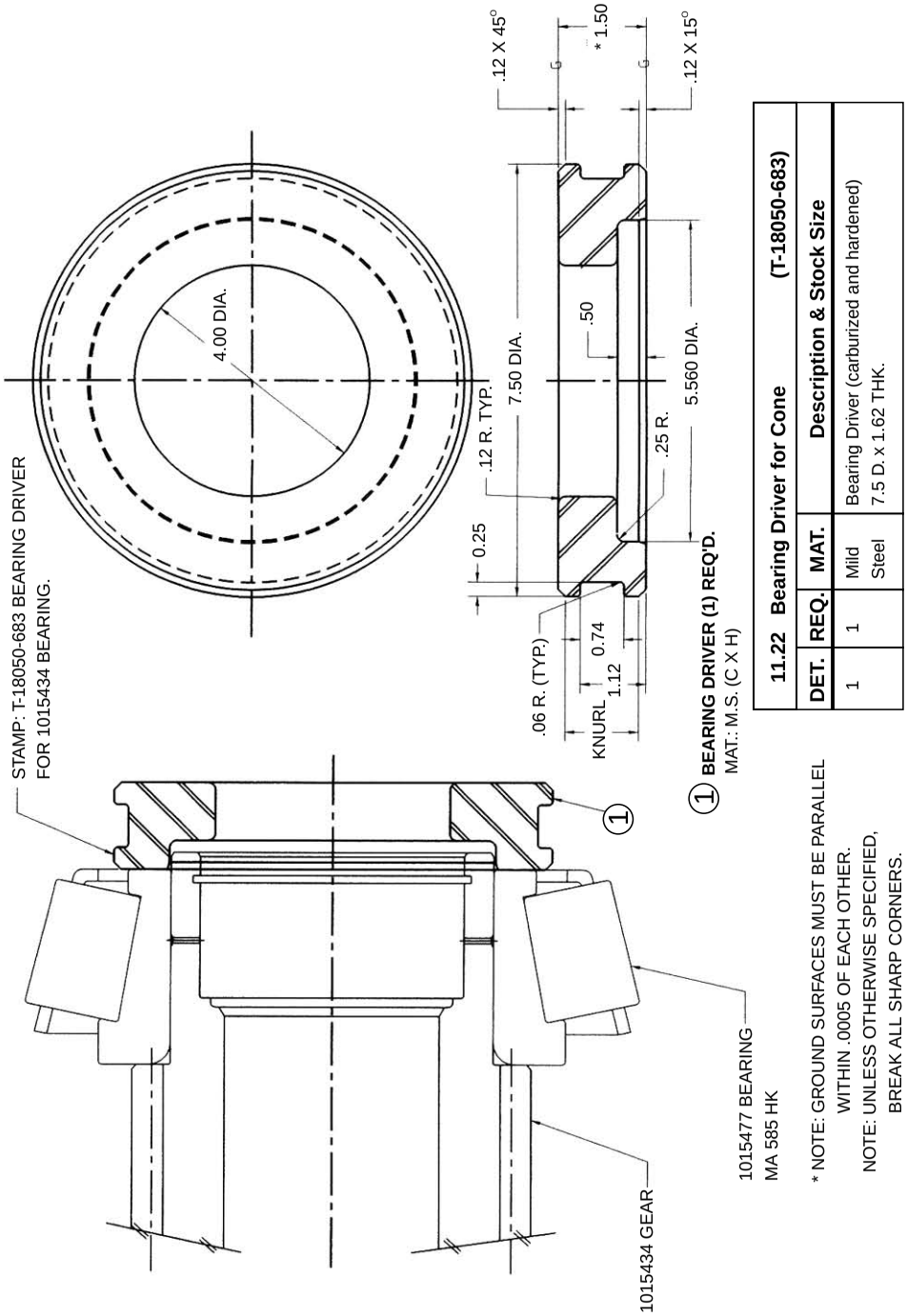
DET.	REQ.	MAT.	Description & Stock Size
5	1	Mild Steel	(A) Puller Base, (HDN. 45-49 Rc.), 9.00 Dia. x 3.75 THK.
3	1	4340H	(A) Puller Rod, 3.25 Dia. x 27.30 LG.
1	1	Mild Steel	Pusher Plate (HDN. 45-49 Rc.), 13.62 Dia. x 2.75 THK.

T-18050-692 Seal Driver


12.88 DIA.
12.38 DIA.
10.25 DIA.
11.799 DIA.
.06 X 45°
.31
.70
* 2.00
* 0.984
.06 X 45°
.12 X 15°
TYP. (2) PLACES
.90 KNURL
.06 R. TYP.
.12 R. TYP.
U'CUT
① SEAL DRIVER (1) REQ'D. (DOUBLE DUTY DRIVER)
MAT.: M.S. (CARB. & HDN.)
NOTE: PRESS SECOND SEAL INTO CARRIER FLUSH WITH DRIVER FLANGE SHOWN IN THE UP POSITION.
① FLANGE UP. PRESS IN SECOND SEAL.
① FLANGE DOWN. PRESS IN FIRST SEAL.
1015513 OIL SEAL (2) REQ'D.
NOTE: PRESS SEAL INTO CARRIER WITH DRIVER FLANGE DOWN. FIRST SEAL TO BE INSERTED AS SHOWN.
1015301 - CARRIER
1015479 BEARING
MA 590 FC - CUP
* NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER.
NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.

11.21 Seal Driver (T-18050-692)			
DET.	REQ.	MAT.	Description & Stock Size
1	1	Mild Steel	Driver - Seal (carburized and hardened), 13.0 O.D. x 1.0 WALL x 2.00 THK.

T-18050-683 Bearing Driver for Cone

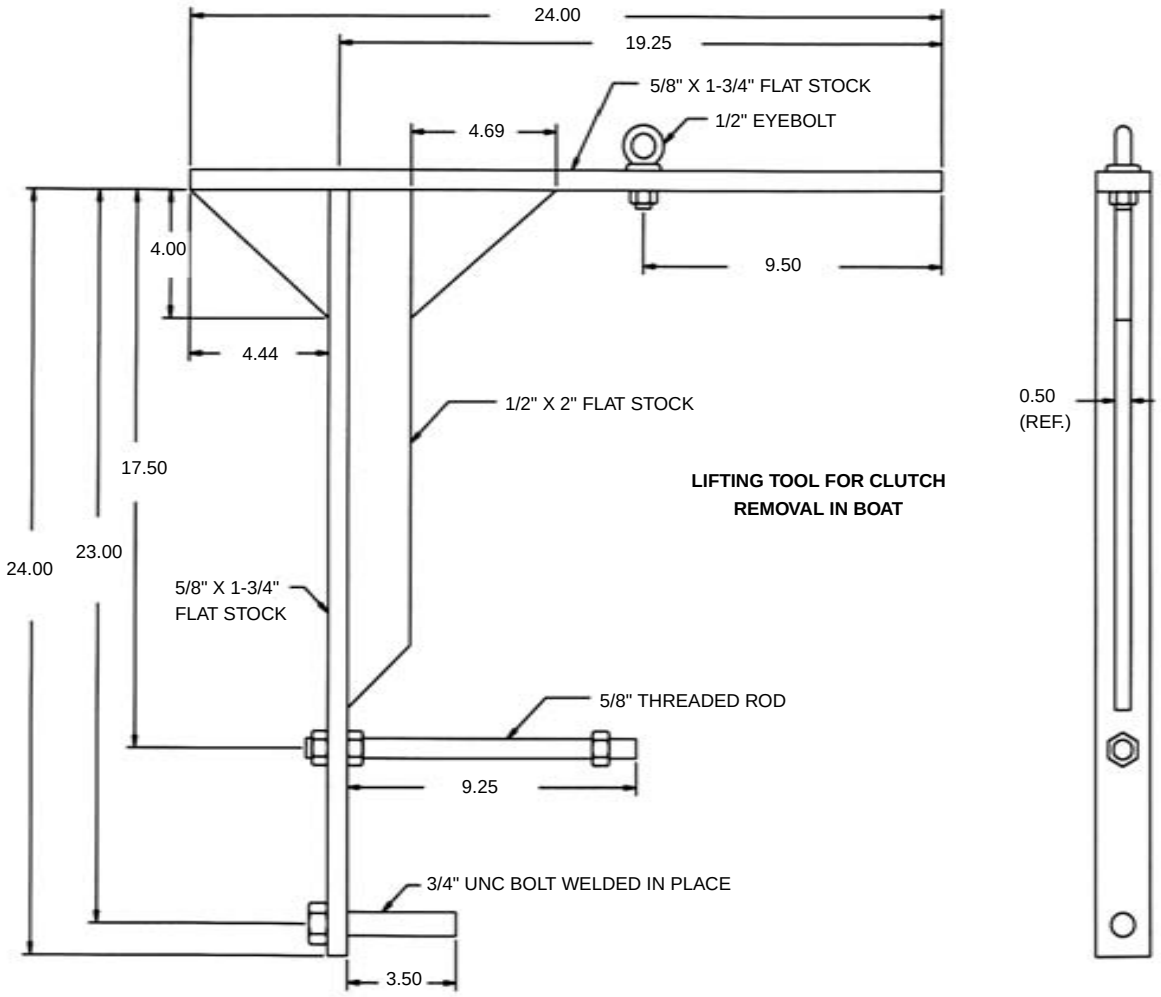


11.22 Bearing Driver for Cone (T-18050-683)

DET.	REQ.	MAT.	Description & Stock Size
1	1	Mild Steel	Bearing Driver (carburized and hardened) 7.5 D. x 1.62 THK.

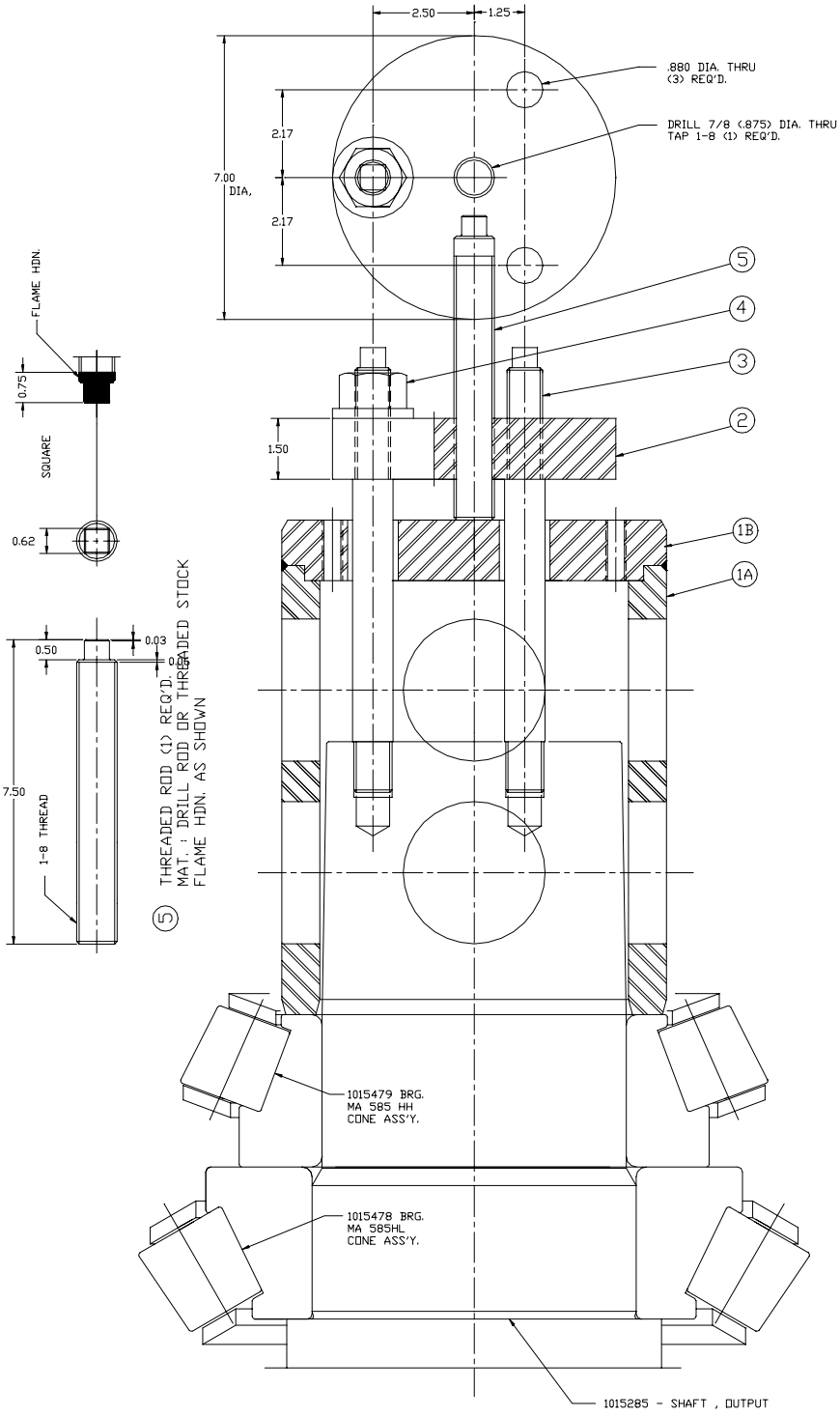
* NOTE: GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER.
NOTE: UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS.

T-05600 Lifting Tool for Clutch Removal in Boat

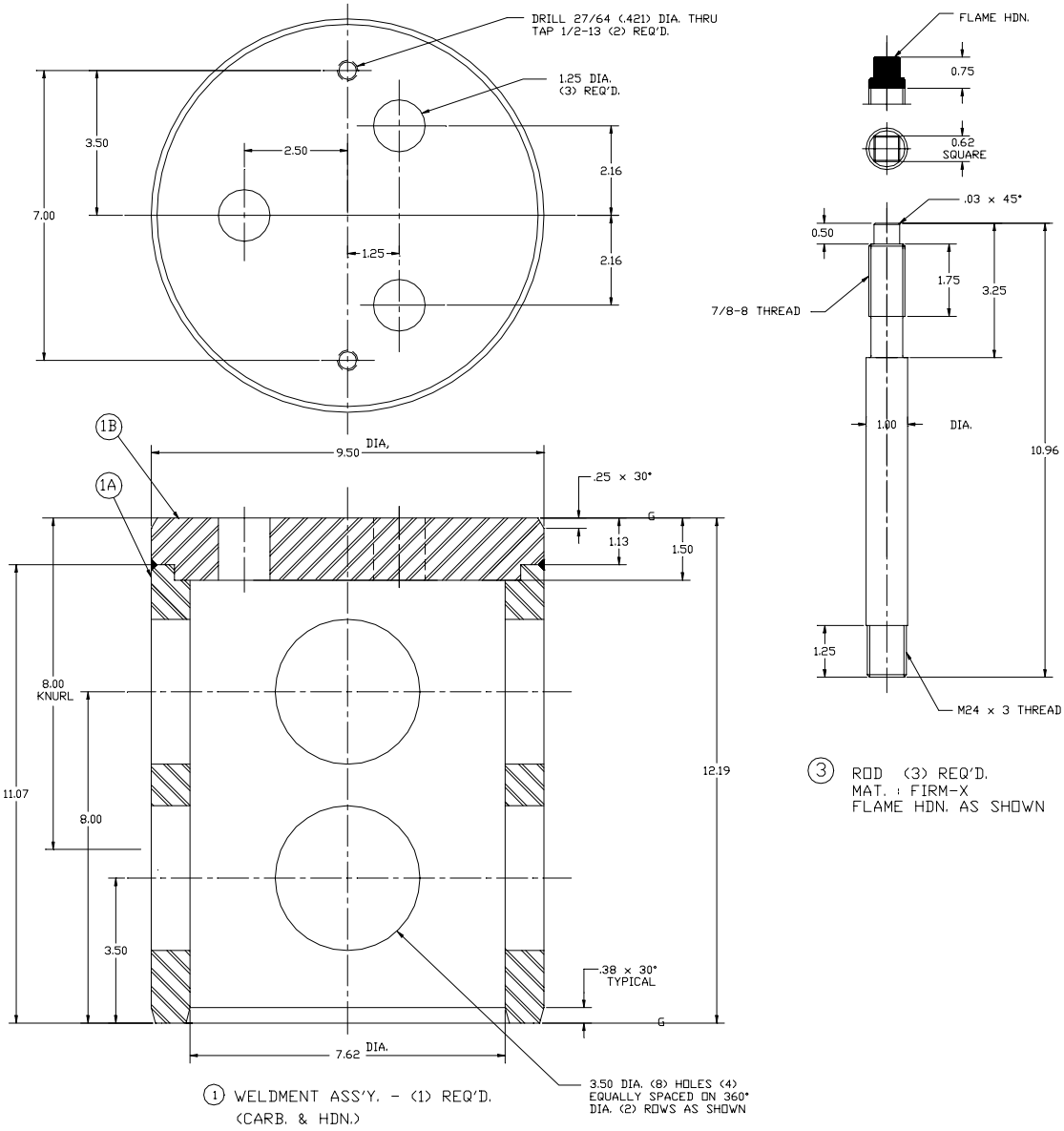


11.23 Lifting Tool for Clutch Removal in Boat (T05600)			
DET.	**REQ.**	**MAT.**	**Description & Stock Size**
			As shown.

T-18050-688 (1 of 2)



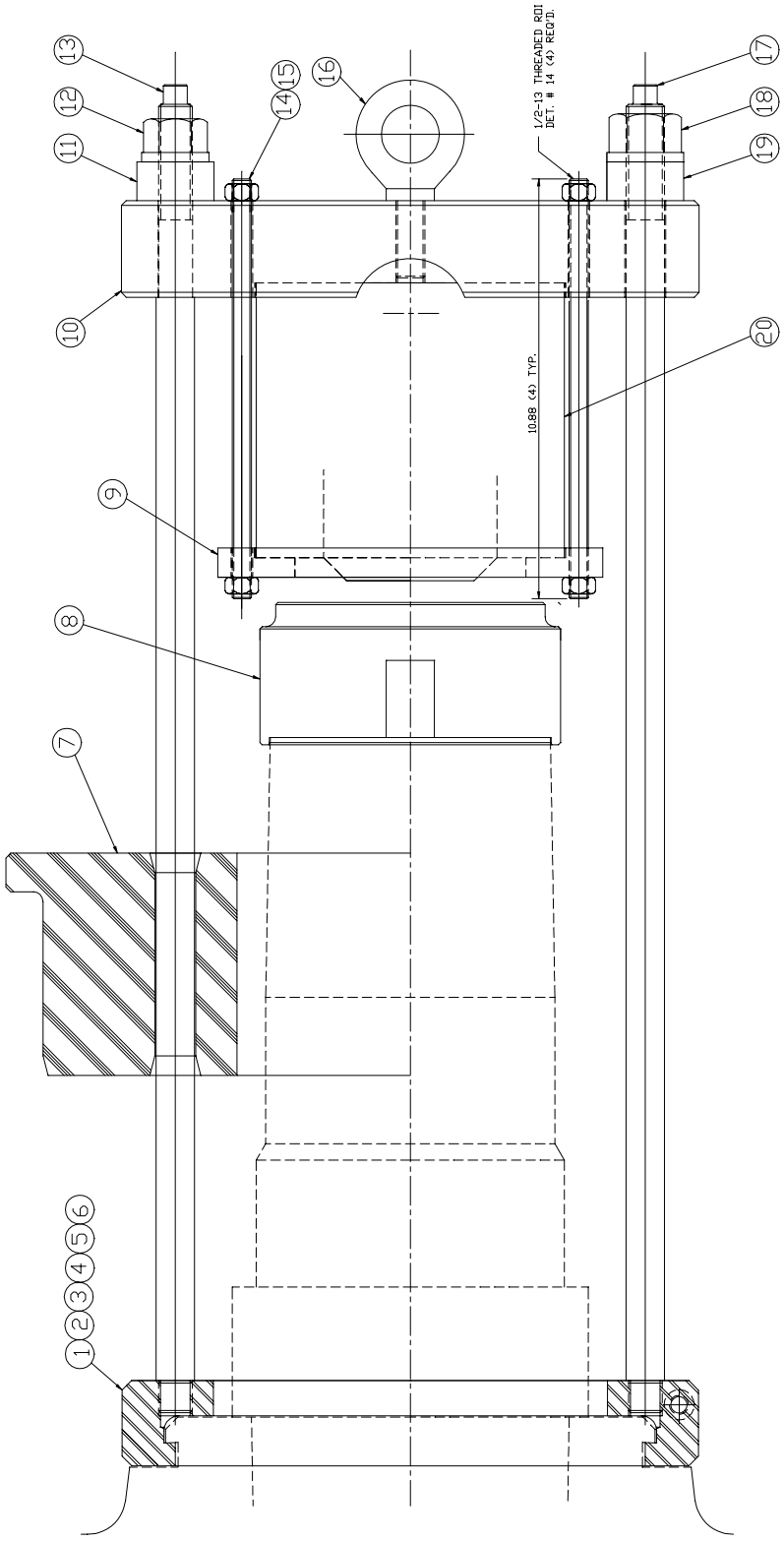
T-18050-688 (2 of 2)



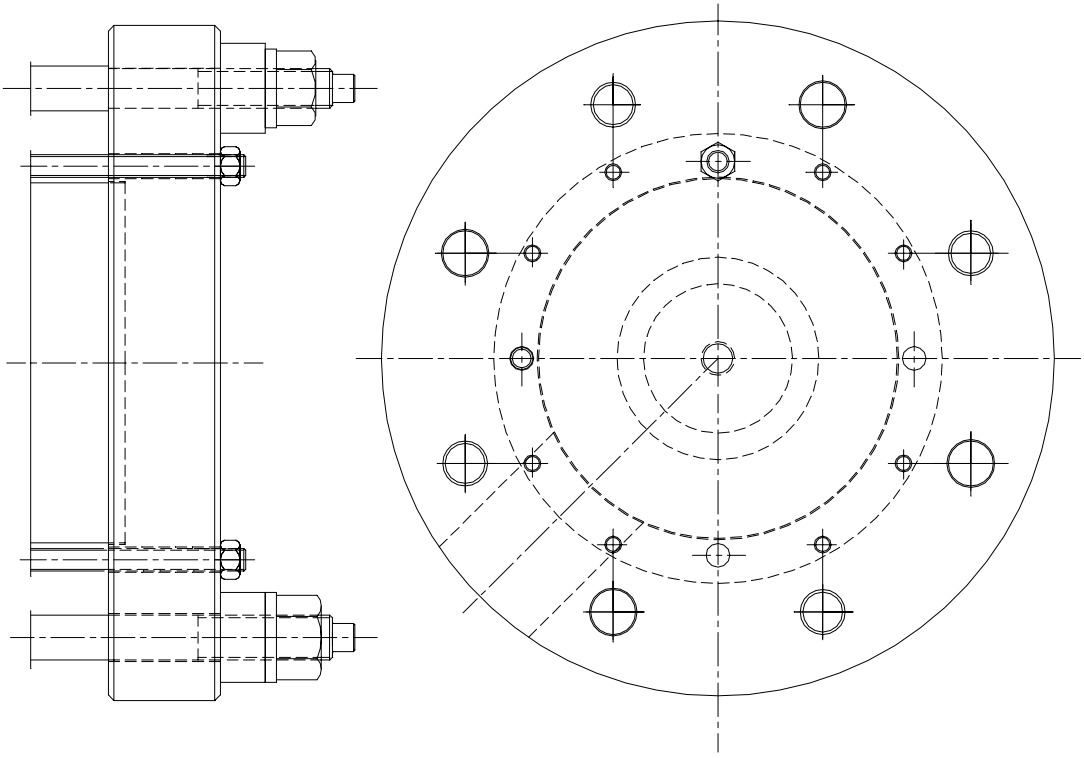
NOTE : GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER
NOTE : UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS

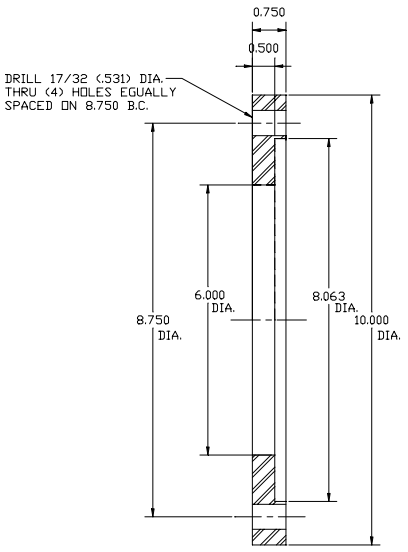
BEARING DRIVER - CONE (T-18050-688)				
DET.	REQ.	MAT.	DESCRIPTION	STOCK SIZE
5	1	STK.	THREADED ROD	1-8 THREAD x 8.0 LG.
4	3	STK.	FLANGE NUT	7/8-8 THREAD
3	3	FIRM-X	ROD	1.0 DIA. x 11.25 LG.
2	1	M.S.	TOP PLATE (C x H)	7.0 DIA. x 1.50 THK.
1B	1	M.S.	TOP PLATE	10.0 DIA. x 1.25 TH'K.
1A	1	TUB.	TUBE - DRIVER	9.5 x 1.0 WALL x 12.0 LG.
1	1		WELDMENT ASS'Y.	

T-20023-1 (1 of 6)



T-20023-1 (2 of 6)

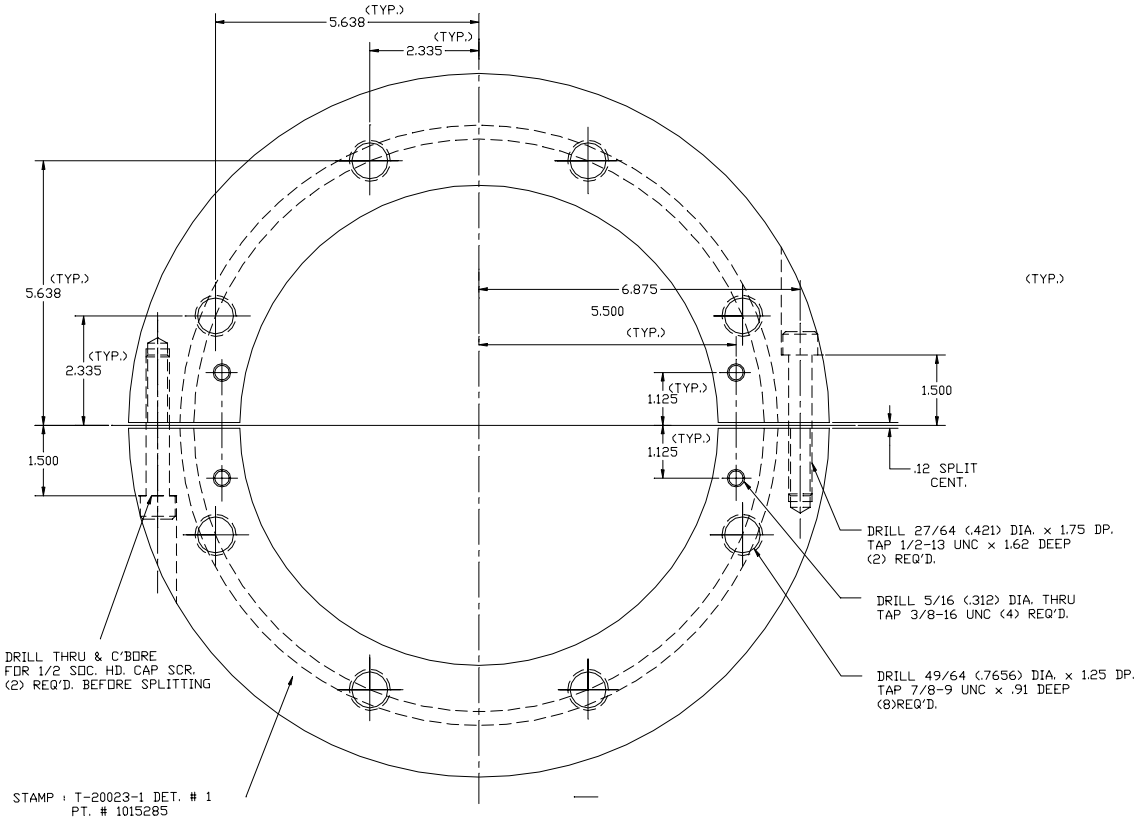


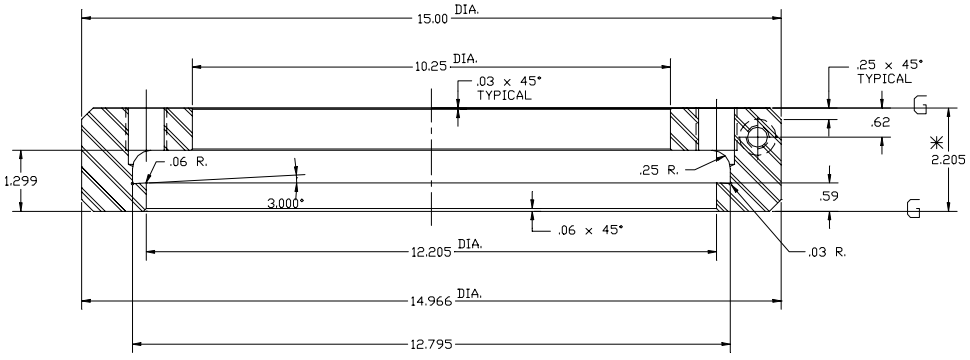


(9) SUPPORT - CYLINDER (1) REQ'D.
MAT. : M.S. (HDN. 45-49 Rc)

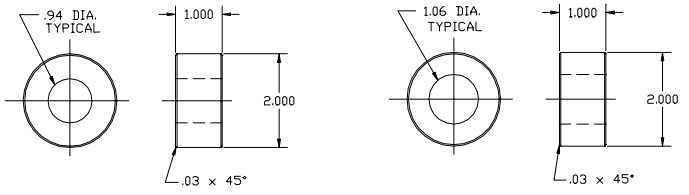
Output Gear to Shaft Puller (T-20023-1; 1&2 of 6			
DET	REQ	MAT.	DESCRIPTION & STOCK SIZE
20	1	PUR.	ENERPAC HYD. CYLINDER #RR-1502
19	4	4140	SPACER (HDN. 52-59 Rc) 2.0 DIA. x 1.12 TH'K.
18	4	PUR.	JERGENS FLANGE NUT #19910 1-8
17	4	PUR.	ROD (HDN. 45-49 Rc) 1.000 DIA. x 36.0 LG.
16	1	PUR.	JERGENS SHOULDER EYE BOLT #18506
15	8	STK.	HEX HD. JAM NUT 1/2-13
14	4	STK.	THREADED ROD 1/2-13 x 11.25 LG.
13	4	PUR.	ROD 1.000 DIA. x 36.0 LG.
12	4	PUR.	JERGENS FLANGE NUT #19909 7/8-9
11	4	4140	SPACER (HDN. 52-59 Rc) 2.0 DIA. x 1.12 TH'K.
10	1	M.S.	TOP PLATE 15.25 DIA. x 2.62 THK.
9	1	M.S.	SUPPORT-CYLINDER 10.5 DIA. x .75 THK.
8	1	M.S.	SPACER - SHAFT 8.25 DIA. x4.0 THK.
7	1	PUR.	STUD LOCATOR POLY. 21.00 DIA. x 5.75 TH'K.
6	4	STK.	SOC. HD. CAP SCR. 3/8-16 x 1.0 LG.
3	2	M.S.	RETAINER (HDN. 45-49 Rc) .38 x 1.75 x 3.75
2	2	STK.	JERGENS SHOULDER SCR. #41717 .499 D. x 7/8
1	1	4140	COLLAR (HDN. 45-49 Rc) 15.25 DIA. x 2.38 THK.

T-20023-1 (3 of 6)





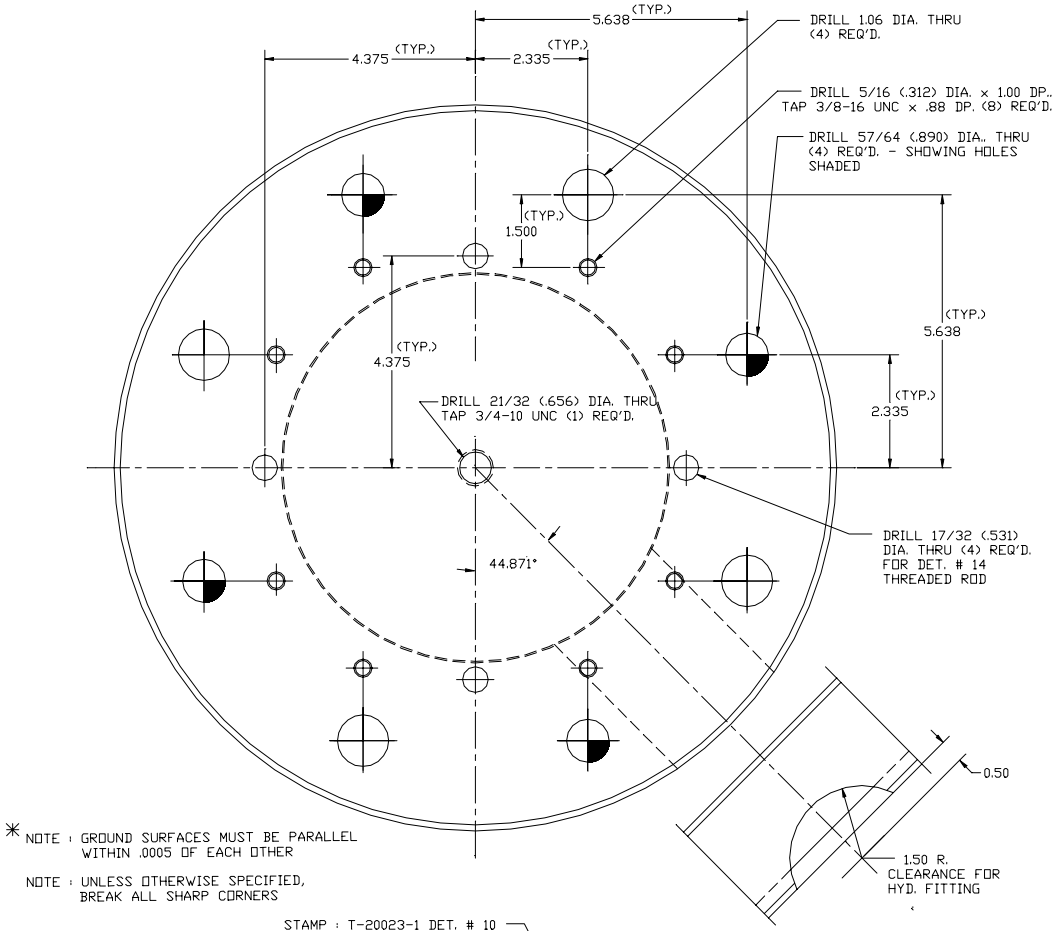
(1) COLLAR (1) REQ'D.
MAT. : 4140 (HDN. 45 - 49 Rc)

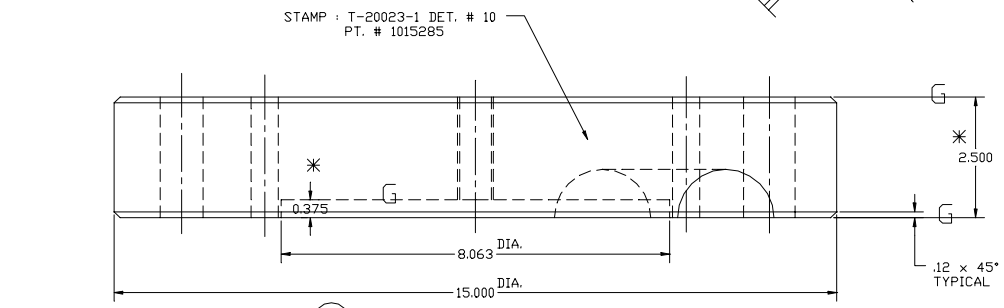


(11) SPACER (4) REQ'D.
MAT. : 4140 (HDN. 52 - 59 Rc)

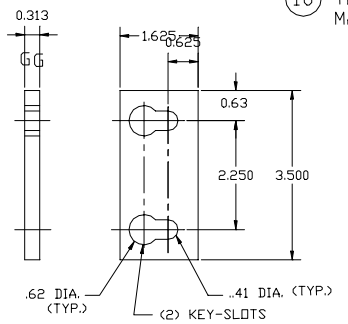
(19) SPACER (4) REQ'D.
MAT. : 4140 (HDN. 52 - 59 Rc)

T-20023-1 (4 of 6)


5.638 (TYP.)
4.375 (TYP.)
2.335 (TYP.)
DRILL 1.06 DIA. THRU (4) REQ'D.
DRILL 5/16 (.312) DIA. x 1.00 DP., TAP 3/8-16 UNC x .88 DP. (8) REQ'D.
DRILL 57/64 (.890) DIA., THRU (4) REQ'D. - SHOWING HOLES SHADED
1.500 (TYP.)
4.375 (TYP.)
5.638 (TYP.)
2.335 (TYP.)
DRILL 21/32 (.656) DIA. THRU TAP 3/4-10 UNC (1) REQ'D.
DRILL 17/32 (.531) DIA. THRU (4) REQ'D. FOR DET. # 14 THREADED ROD
44.871°
0.50
1.50 R. CLEARANCE FOR HYD. FITTING
* NOTE : GROUND SURFACES MUST BE PARALLEL WITHIN .0005 OF EACH OTHER
NOTE : UNLESS OTHERWISE SPECIFIED, BREAK ALL SHARP CORNERS



(10) TOP PLATE (1) REQ'D.
MAT. : M.S. (HDN. 45 - 49 Rc)



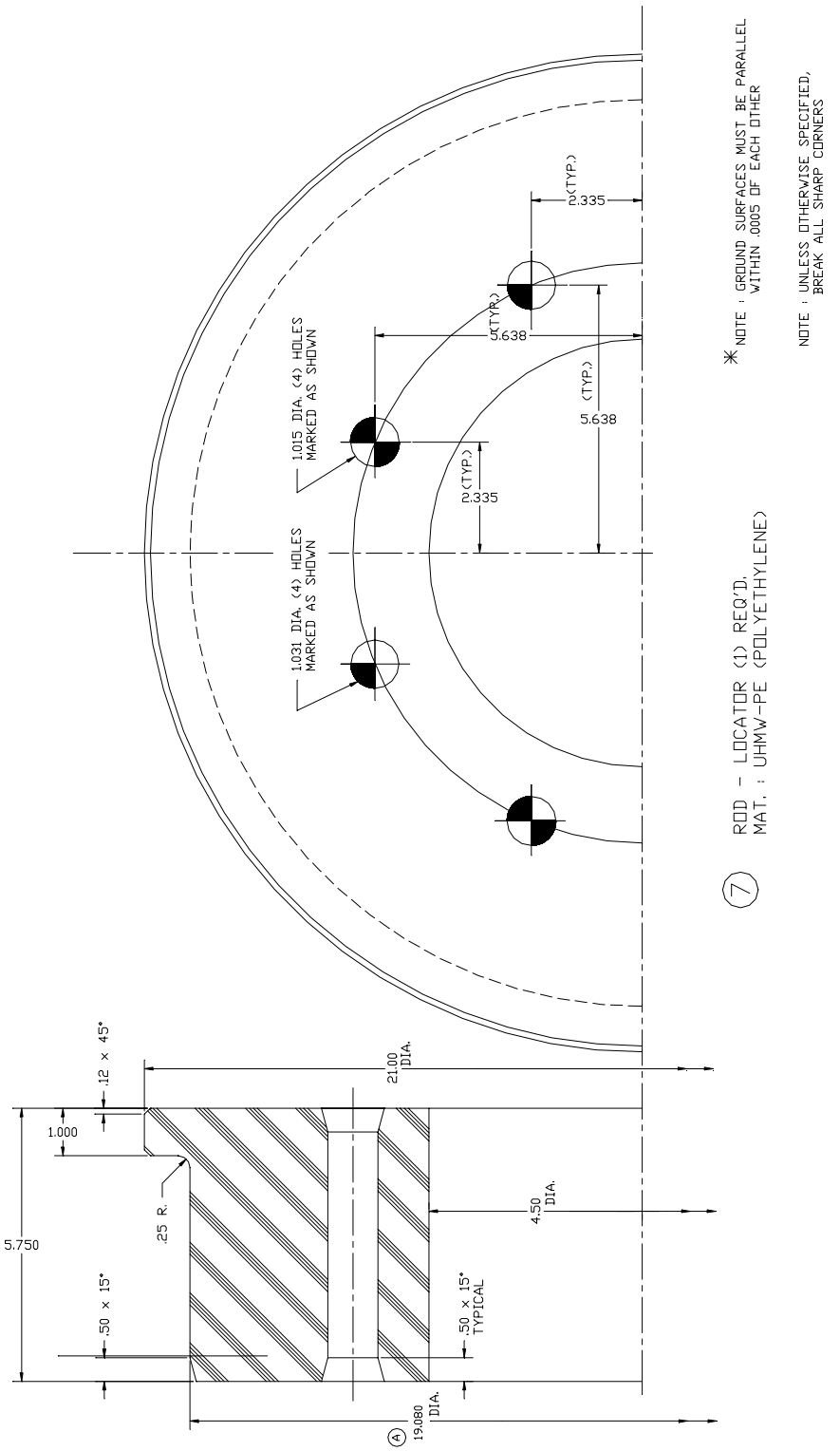
(3) RETAINER (2) REQ'D.
MAT. : M.S.
(HDN. 45 -49 Rc)

Output Gear to Shaft Puller (T-20023-1; 3&4 of 6

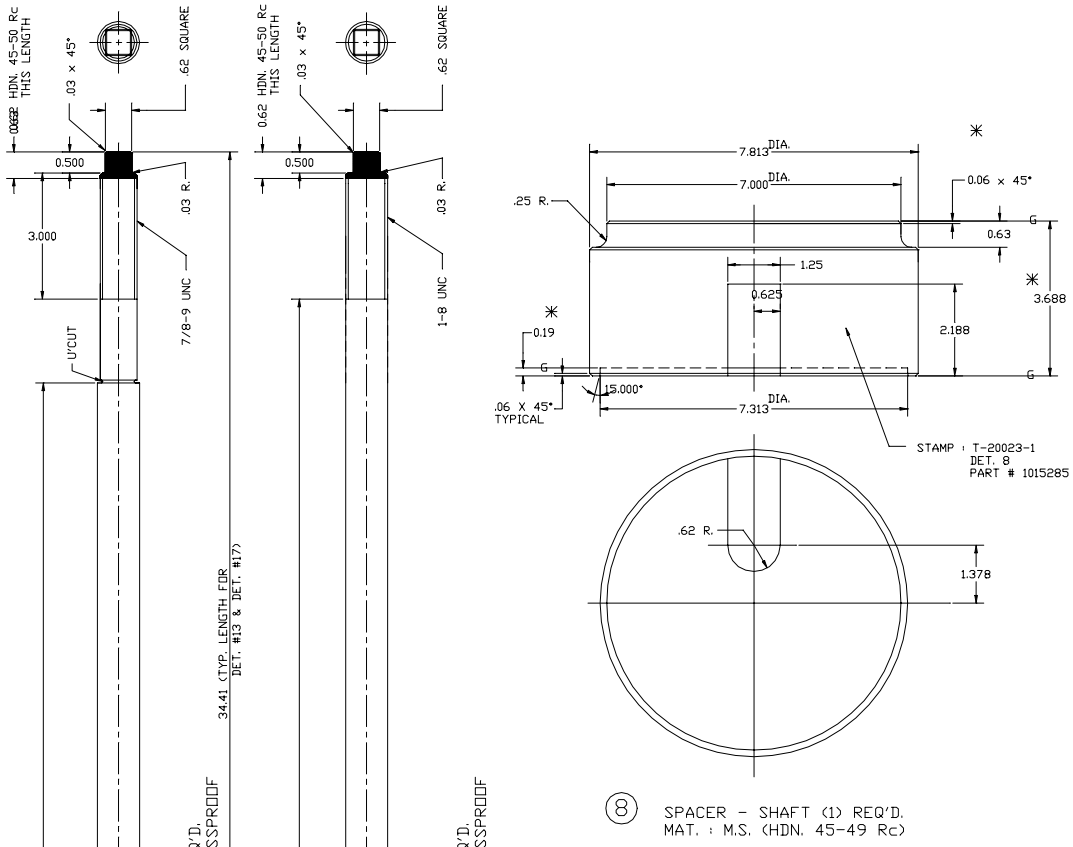
DET.	REQ.	MAT.	DESCRIPTION	STOCK SIZE
19	4	4140	SPACER (HDN. 52-59 Rc)	2.0 DIA. x 1.12 TH'K.
11	4	4140	SPACER (HDN. 52-59 Rc)	2.0 DIA. x 1.12 TH'K.
10	1	M.S.	TOP PLATE	15.25 DIA. x 2.62 THK.
6	4	STK.	SOC. HD. CAP SCR. GRADE 8	3/8-16 x 1.0 LG.
3	2	M.S.	RETAINER (HDN. 45-49 Rc)	.38 x 1.75 x 3.75
2	2	STK.	SOC. HD. CAP SCR. GRADE 8	1/2-13 x 3.0 LG.
1	1	4140	COLLAR (HDN. 45-49 Rc)	15.25 DIA. x 2.38 THK.
DET.	REQ.	MAT.	DESCRIPTION	STOCK SIZE

JPL

T-20023-1 (5 of 6)



T-20023-1 (6 of 6)



(13) ROD (4) REQ'D.
MAT. : STRESSPROOF

(17) ROD (4) REQ'D.
MAT. : STRESSPROOF

(8) SPACER - SHAFT (1) REQ'D.
MAT. : M.S. (HDN. 45-49 Rc)

OUTPUT GEAR TO SHAFT PULLER (T-20023-1 5&6 OF 6)

DET.	REQ.	MAT.	DESCRIPTION	STOCK SIZE	
17	4	PUR. ROD	ROD (HDN. 45-49 Rc) 1.000	DIA. x 36.0	LG.
13	4	PUR. ROD	ROD (HDN. 45-49 Rc) 1.000	DIA. x 36.0	LG.
8	1	M.S.	SPACER - SHAFT 8.25	DIA. x4.0	THK.
7	1	PUR.	ROD - LOCATOR POLY. 21.00	DIA. x 5.75	TH'K.

Engineering Drawings

- ❑ 1016473 Electric Trailing Pump
- ❑ 1015239 MG5600 (7 sheets)
- ❑ 1016001 MG5600 (7 sheets)
- ❑ 1018100 MG5600DR (4 sheets)
- ❑ A7119S Hydraulic Schematic (Mechanical Valve)
- ❑ A7119X Hydraulic Schematic (Electric Valve)
- ❑ S570AH MG5600 Assembly Instructions
- ❑ S570AK MG5600DR Assembly Instructions
- ❑ B3504AH Mass Elastic System (MG5600)
- ❑ B3504AT Mass Elastic System (MG5600DR)

CAUTION

W/MECH. VALVE
ADAPTER, 8P37G
RING, A2669AP

UNIT WITH MECHANICAL VALVE

UNIT WITH ELECTRICAL VALVE

PIN, MA1035A (2)

ADAPTER, 1015291

CAPSCREW, MA1042D (2)

COUPLING ASSY, DRIVE KB2375
• COUPLING, B2375
PIN, M192702

VIEW C-C

W/ELEC. VALVE
ADAPTER ASSY., 1017648
ADAPTER, 1017647
ROLL PIN, M192748

NOTE:
THIS VIEW SHOWS THE PUMP SPACER AS USED WITH THE ELECTRIC VALVE. THIS SPACER IS NOT USED WITH THE MECHANICAL VALVE (SEE SHEET 2)

GEAR RATIOS

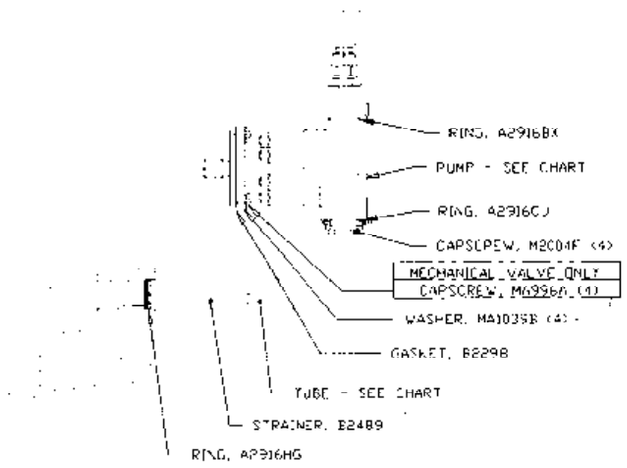
TWIN DISC

1015239

MG-5600 MARINE TRANSMISSION

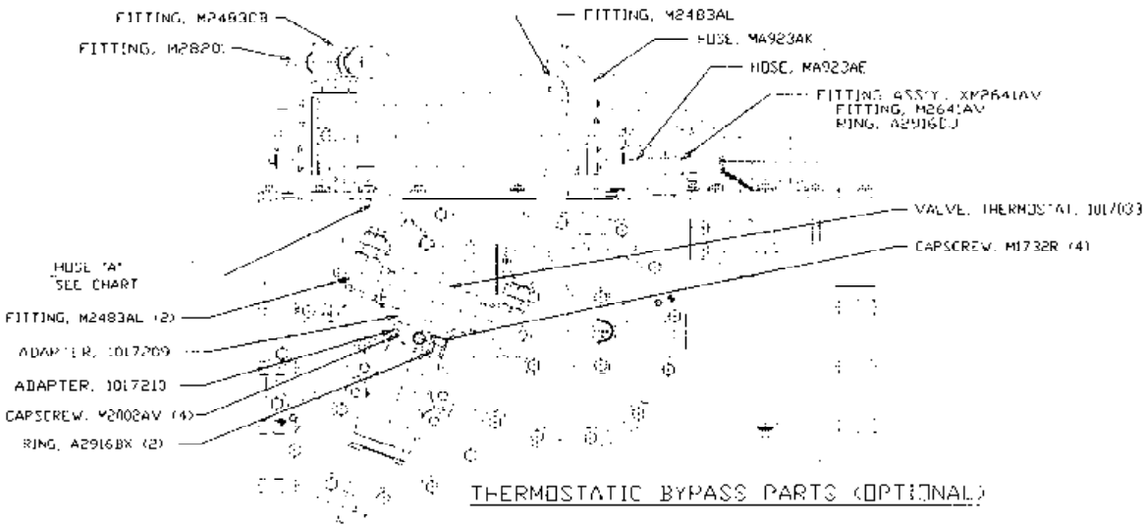
6 5 4 3 2 1

E D C B A

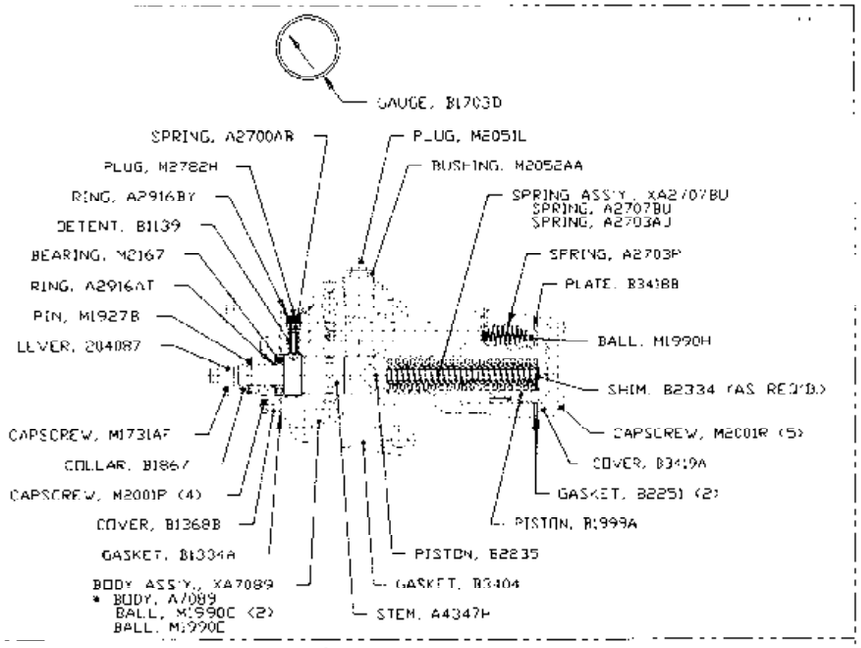


	ENGINE ROTATION	ENGINE FULL LOAD GOVERNED SPEED - R.P.M.		
		900 - 1299	1300 - 1699	1700 - 2100
PUMP	RH	1016698	1016699	1016700
	LH	1016701	1016702	1016703
SUCTION TUBE (MECHANICAL VALVE)	RH	1016668	1016668A	1016668B
	LH	1016670	1016670A	1016670B
SUCTION TUBE (ELECTRIC VALVE)	RH	1017609	1017609A	1017609B
	LH	1017611	1017611A	1017611B
HOSE "A" (MECHANICAL VALVE)		MA923AE	MA923AE	MA923AE
HOSE "B"✱(MECHANICAL VALVE)		MA923AF	MA923AF	MA923AF
HOSE "A" (ELECTRICAL VALVE)		MA923AG	MA923AG	MA923AG
HOSE "B"✱(ELECTRICAL VALVE)		MA923AG	MA923AG	MA923AG

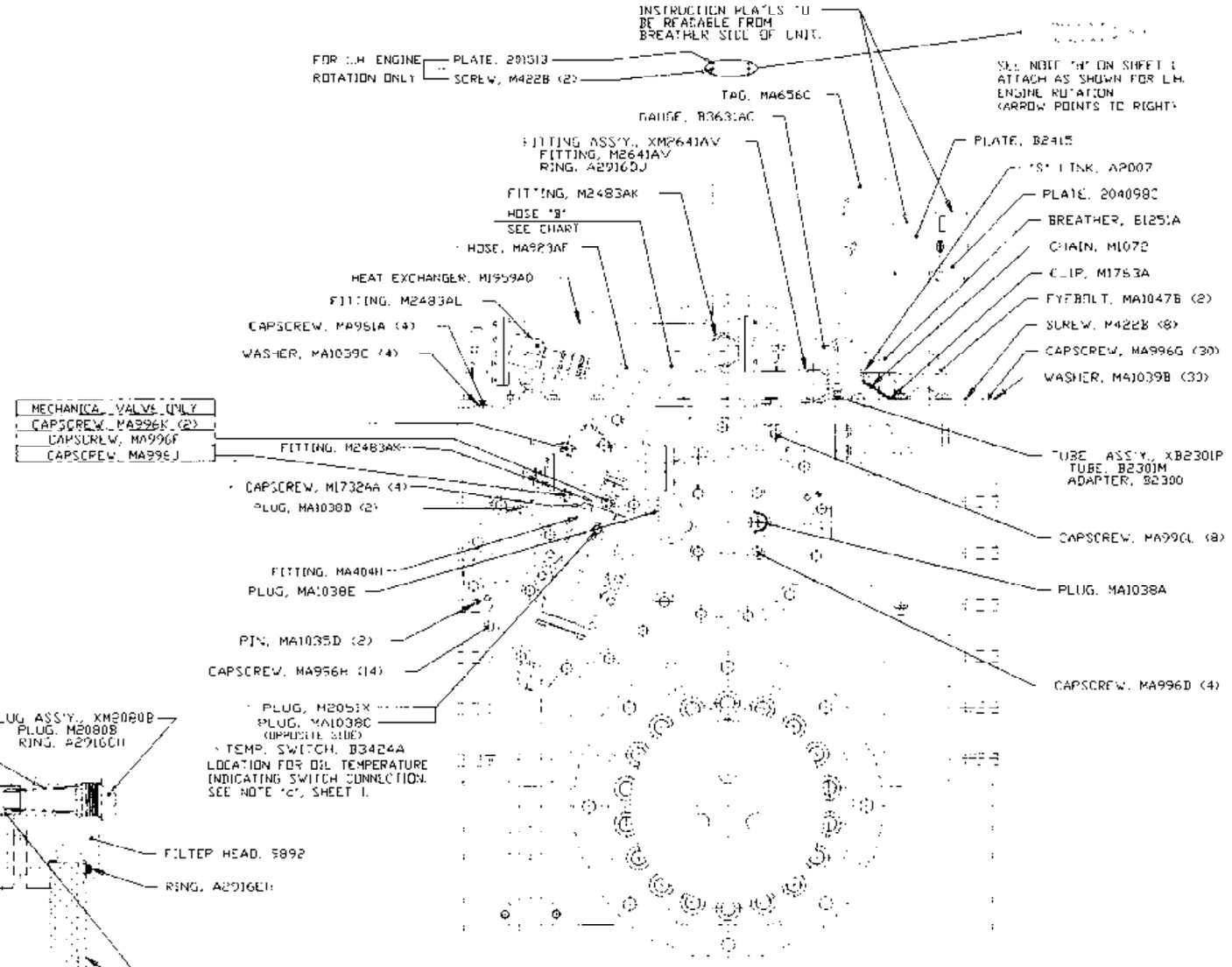
✱THESE HOSES ARE USED WITHOUT THERMOSTAT VALVE. WHEN OPTIONAL THERMOSTAT VALVE IS USED SEE HOSE CALLOUT IN OPTIONAL VIEW AT RIGHT. ALSO SEE OTHER BOXED AREAS FOR OTHER DIFFERENCES BETWEEN MECHANICAL & ELECTRIC VALVES.

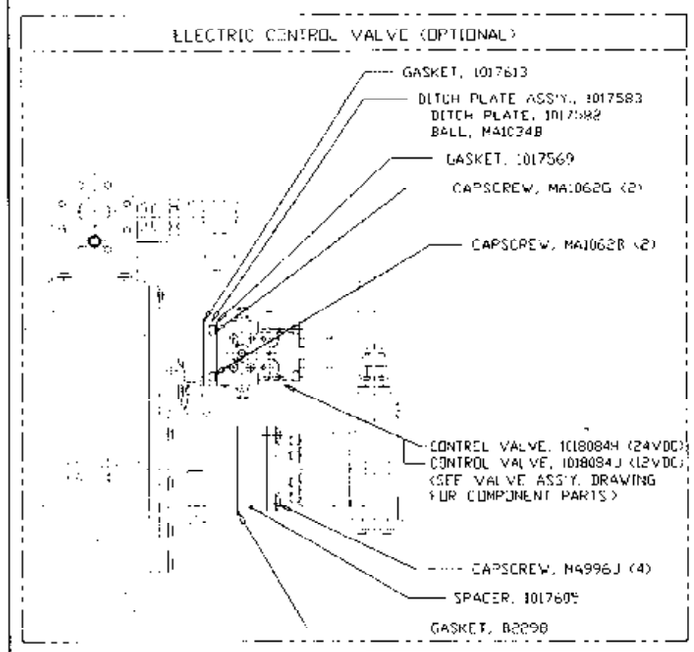


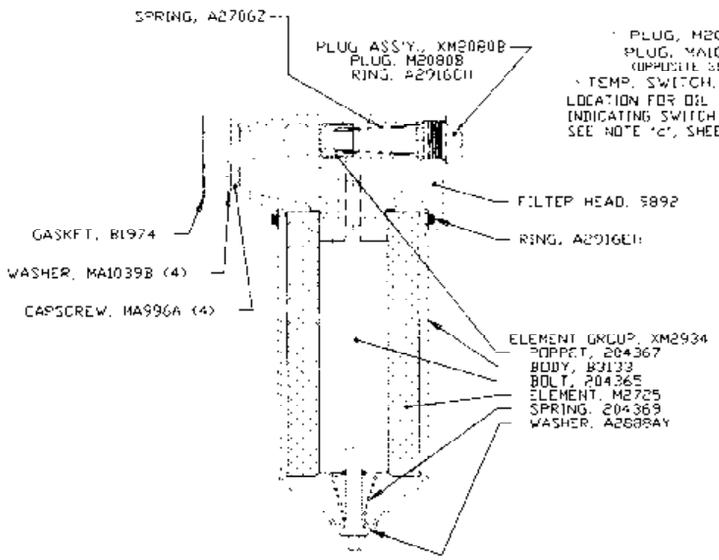
THERMOSTATIC BYPASS PARTS (OPTIONAL)



XA7108A
CONTROL VALVE ASSEMBLY
(MECHANICAL)

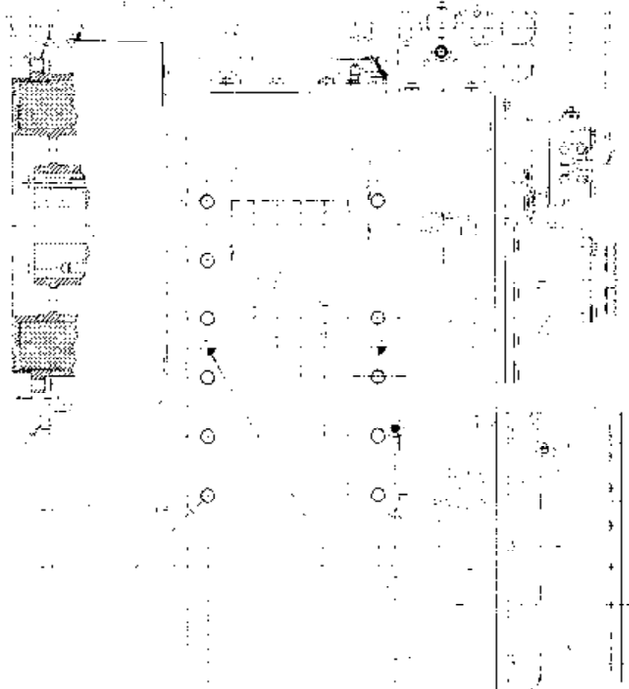




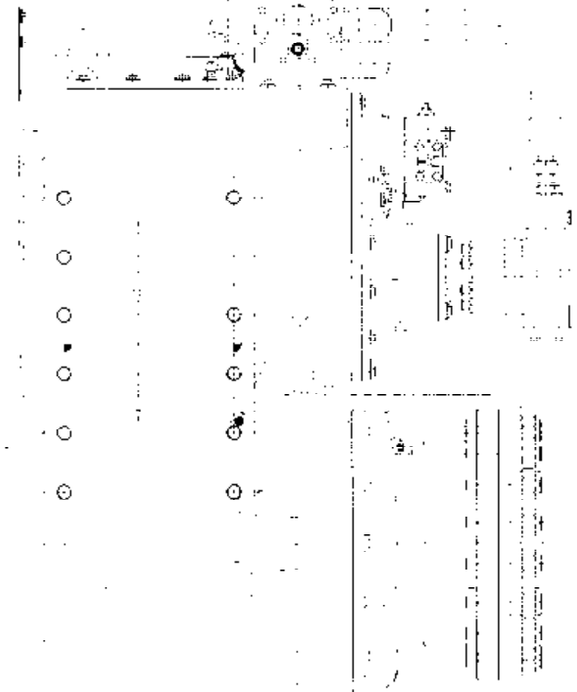


1015239

M5-5600 MARINE TRANSMISSION



SAE #0 FRONT HOUSING
MECHANICAL CONTROL VALVE



SAE #00 FRONT HOUSING
MECHANICAL CONTROL VALVE

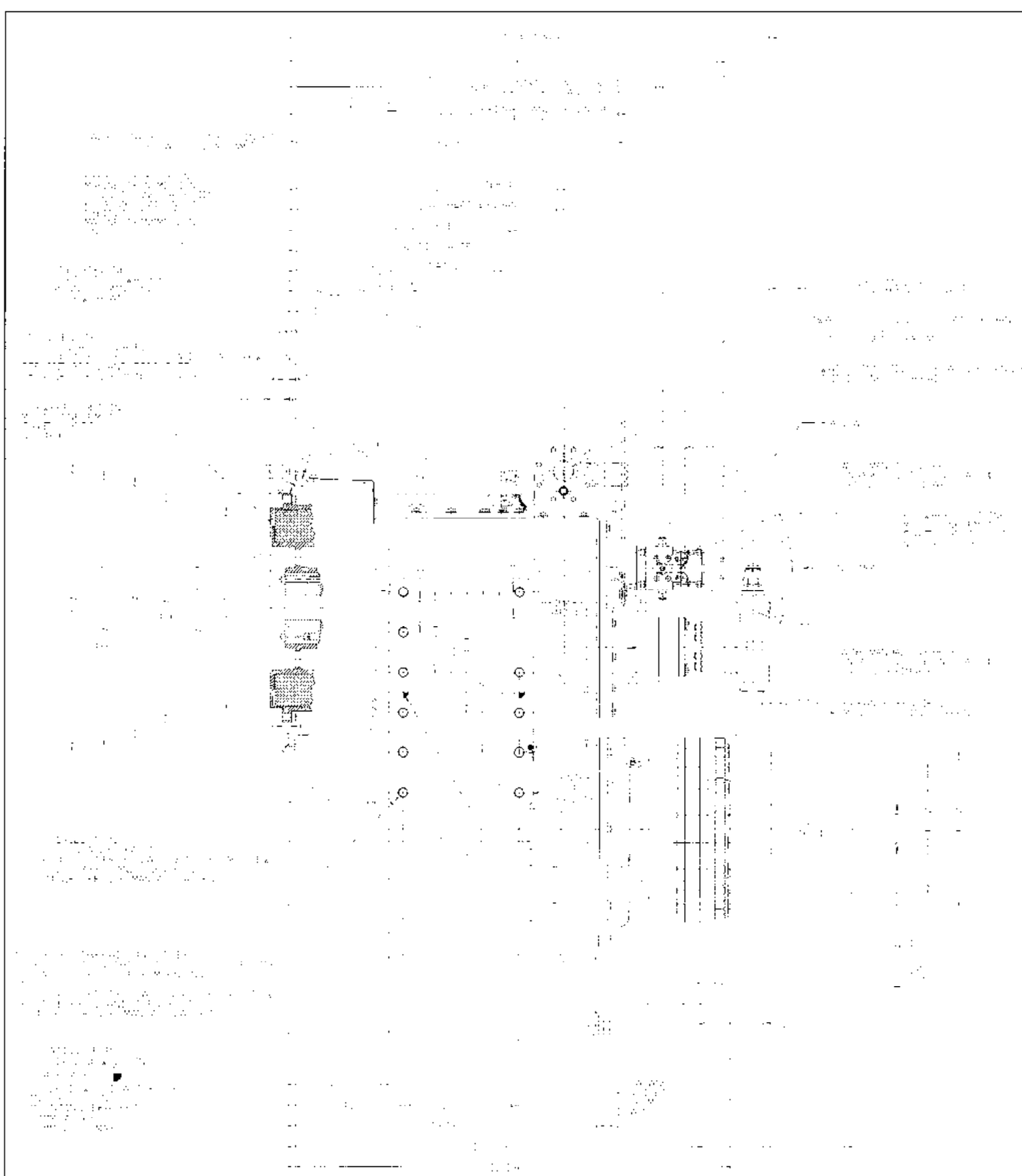
TWIN DISC

1015239

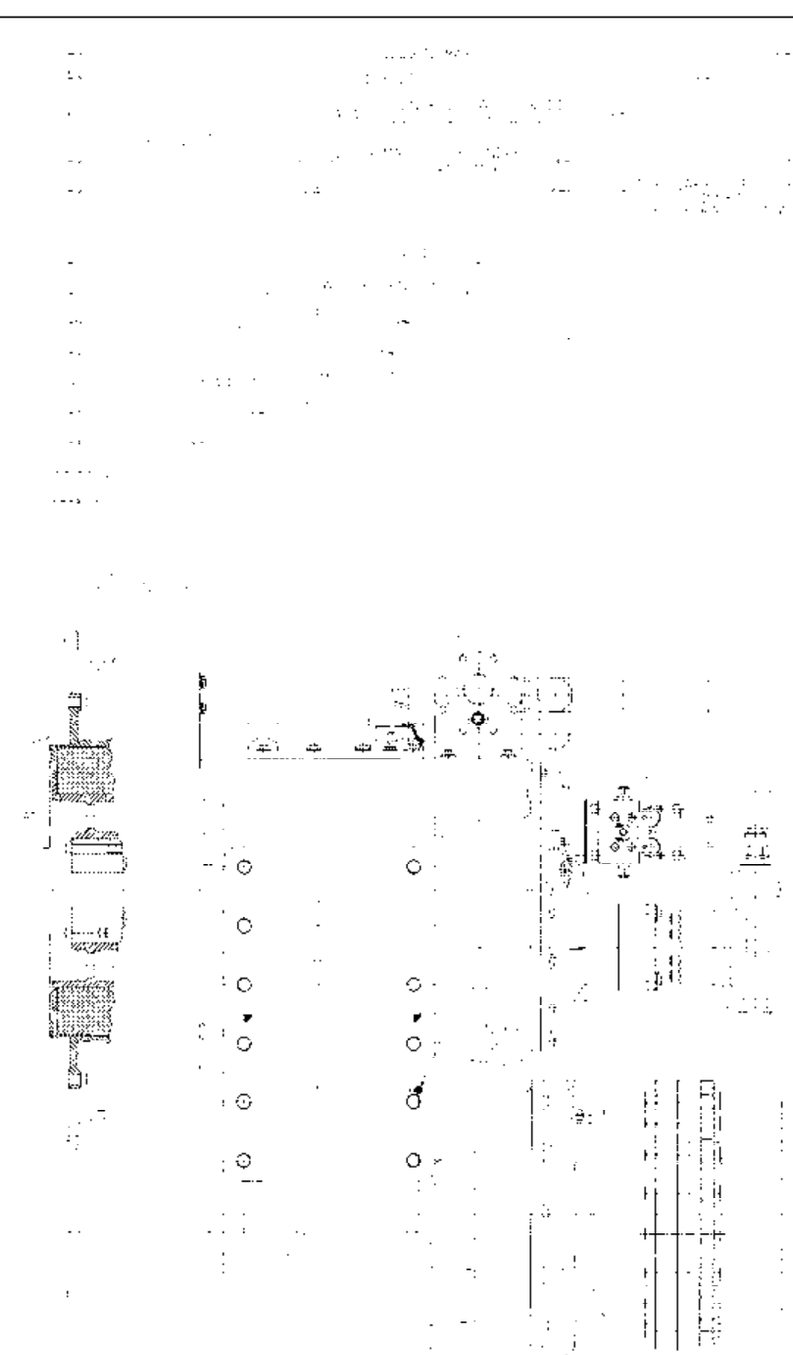
MG-5600 MARINE TRANSMISSION

6 5 4 3 2 1

F D C B A



SAF #0 FRONT HOUSING
OPTIONAL ELECTRIC CONTROL VALVE



SAF #00 FRONT HOUSING
OPTIONAL ELECTRIC CONTROL VALVE

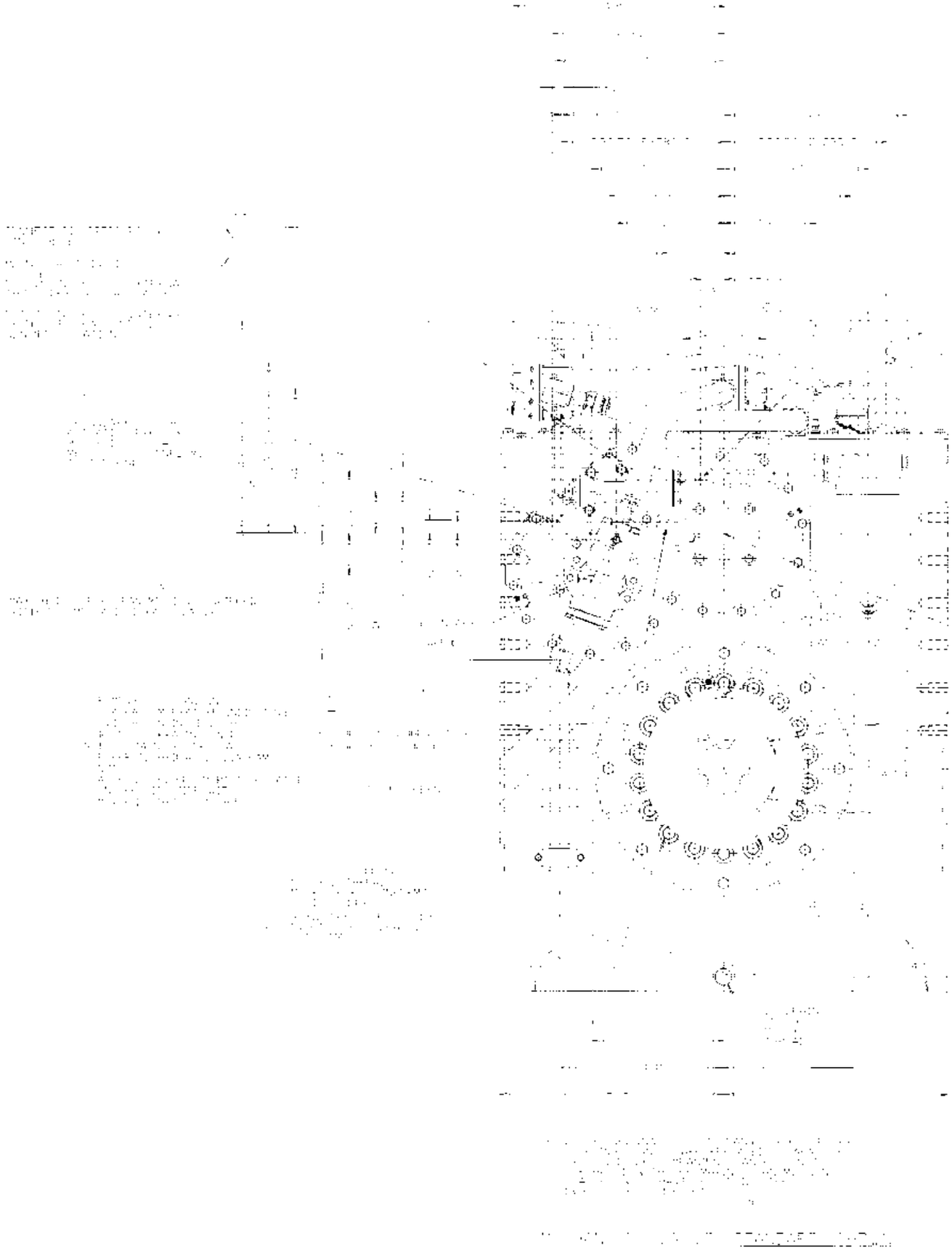
TWIN DISC

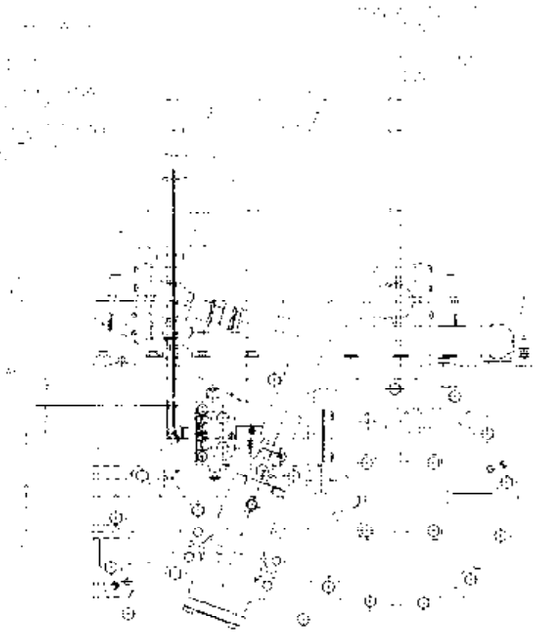
1015239

MG 5000 MARINE TRANSMISSION

6 5 4 3 2 1

E D C B A

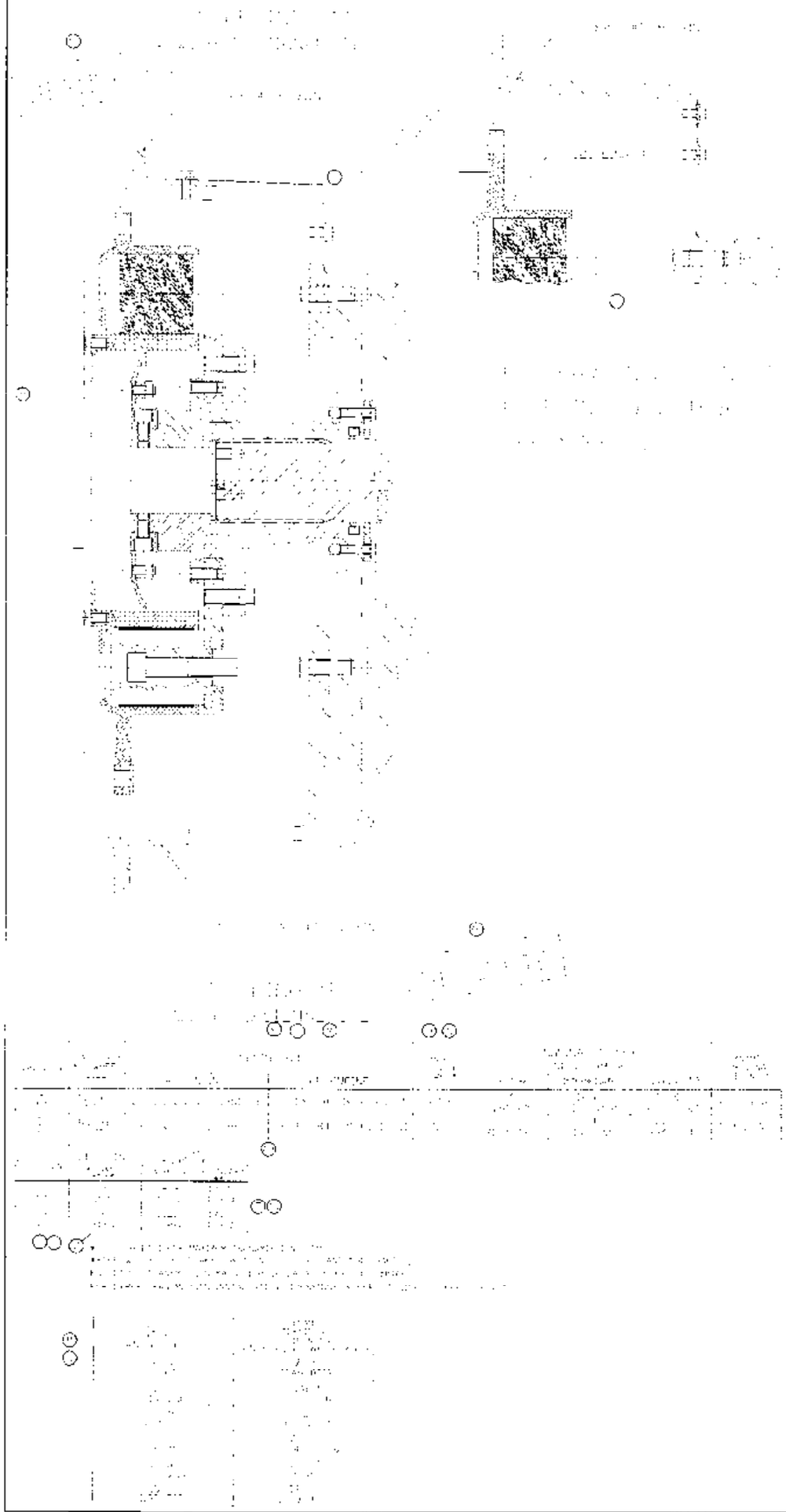


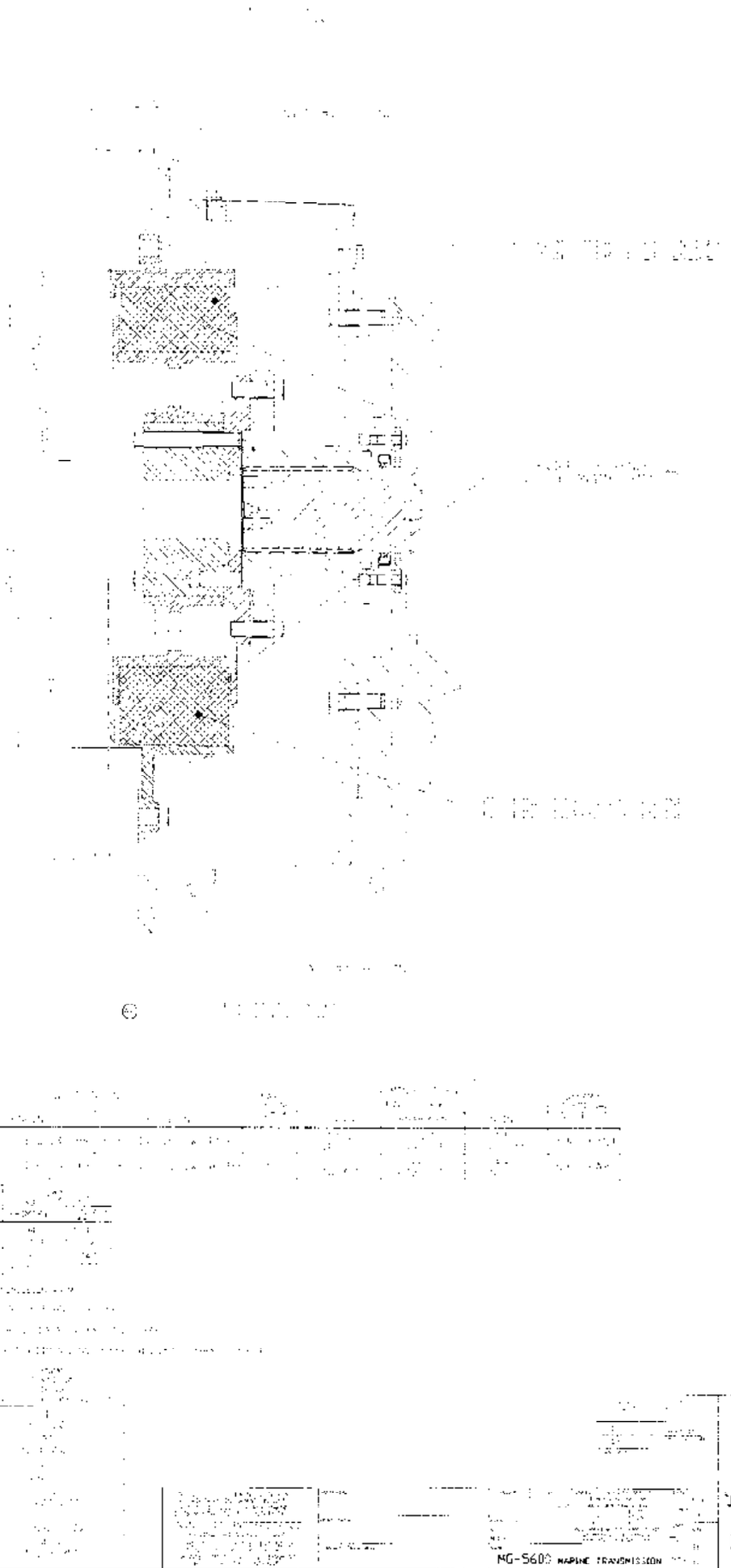


TWIN DISC

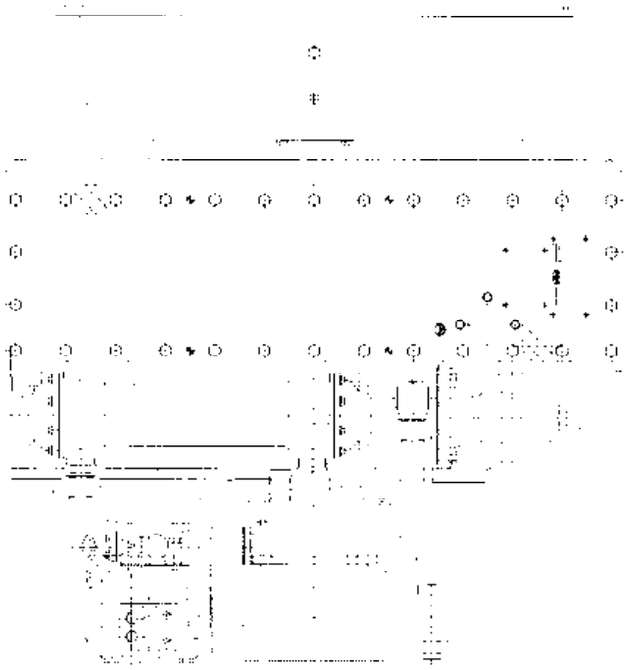
1015239

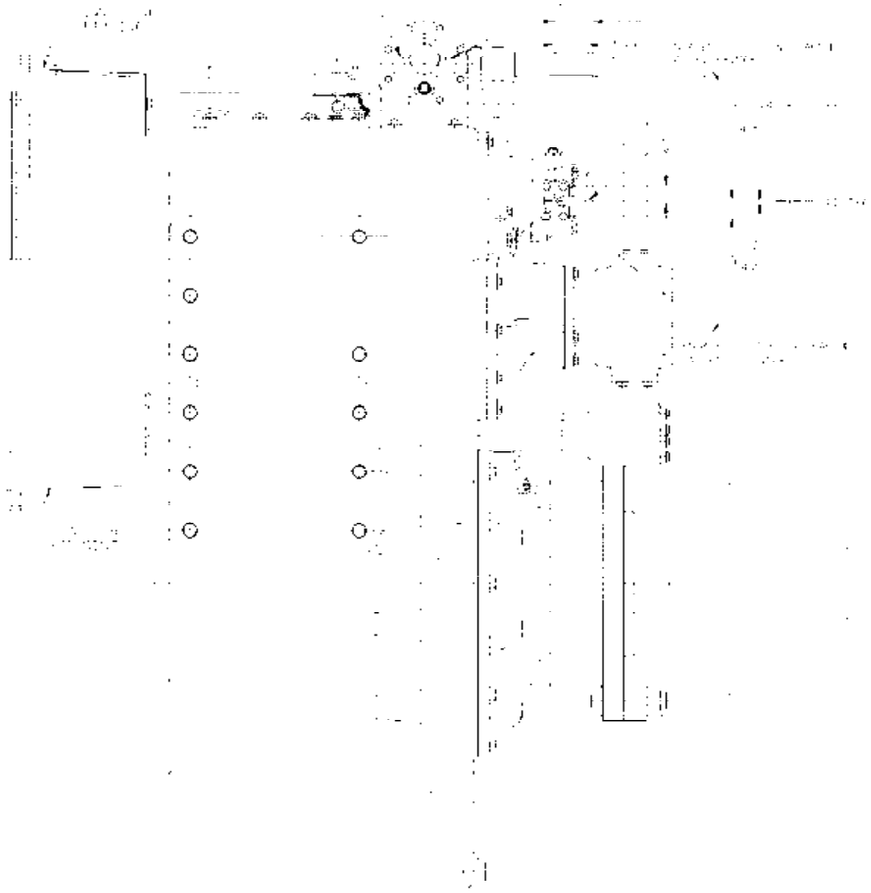
MG-5600 MARINE TRANSMISSION

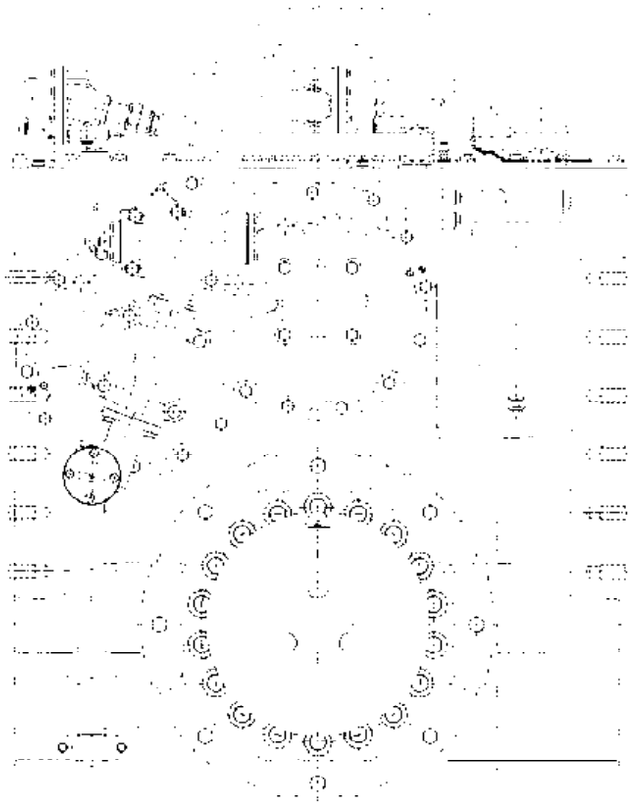


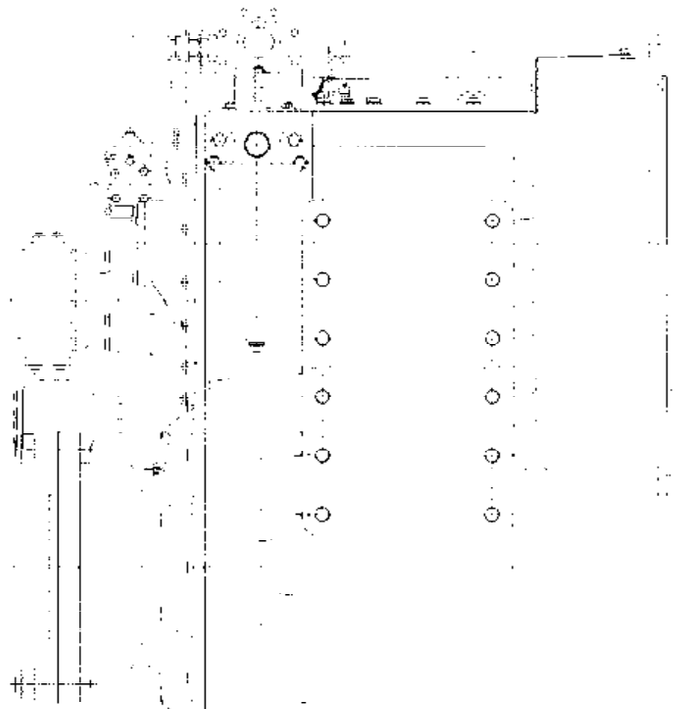


TWIN DISC	
MG-5600 MARINE TRANSMISSION	1015239









SHOWN WITH
SAE 60 FRONT HOUSING
MECHANICAL VALVE

TWIN DISC

1015239

MG5600 MARINE TRANSMISSION

6 5 4 3 2 1

E D C B A

FOR 1016001 UNIT
PINION ASS'Y, 1016486 (2) * GEAR, 1016485 * HUB, 1016484 6.04:1 RATIO, 24T
PINION ASS'Y, 1016488 (2) * GEAR, 1016495 * HUB, 1016484 5.04:1 RATIO, 26T
PINION ASS'Y, 1016489 (2) * GEAR, 1016487 * HUB, 1016484 4.03:1 RATIO, 33T
PINION ASS'Y, 1016490 (2) * GEAR, 1016496 * HUB, 1016484 3.50:1 RATIO, 37T
PINION ASS'Y, 1016493 (2) * GEAR, 1016497 * HUB, 1016484 2.98:1 RATIO, 42T
PINION ASS'Y, 1016494 (2) * GEAR, 1016498 * HUB, 1016484 2.53:1 RATIO, 47T

FOR 1017614 UNIT
PINION ASS'Y, 1017632 (2) * GEAR, 1017629 * HUB, 1016484 5.04:1 RATIO, 28T
PINION ASS'Y, 1017633 (2) * GEAR, 1017630 * HUB, 1016484 4.03:1 RATIO, 33T
PINION ASS'Y, 1017634 (2) * GEAR, 1017631 * HUB, 1016484 3.50:1 RATIO, 37T
PINION ASS'Y, 1016491 (2) * GEAR, 1016497 * HUB, 1016484 2.98:1 RATIO, 42T
PINION ASS'Y, 1016492 (2) * GEAR, 1016498 * HUB, 1016484 2.53:1 RATIO, 47T

COVER ASS'Y, 1015500
* COVER, 1015499
ADAPTER, B1966A

BAFFLE ASS'Y, 1019068
BAFFLE, 1019067
NUT, MA1054A (3)

WASHER, M2081D (3)

SCREW, MA960D (3)

RING, A2916W

SCREEN, MA993

GASKET, 1015501

CONE ASS'Y, MA585AR (2)
CUP, MA590A (2)

FOR 1016001 UNIT	FOR 1017614 UNIT
GEAR, 1015453	GEAR, 1017625

NIPPLE, M2987P

GASKET, 1015506

COUPLING, M29879

CARRIER, 1015498

GASKET, 1015507

BEARING ASS'Y, 1015560 (2)
CONE ASS'Y, MA585HM
CUP, MA590AT

SHIM, 1015463
SHIM, 1015464
SHIM, 1015465
— AS REQ'D SEE NOTE #6 - A (PRIMARY & SECONDARY)

MANIFOLD ASS'Y., 1015510
* MANIFOLD, 1015509
BALL, MA1034K (3)
BALL, MA1034L (2)

RING, A2916KD

COVER, 1015518

RETAINER ASS'Y, 1015467 (2)
* RETAINER, 1015466
PIN, MA1036B (2)

PLUG, 1015722

FLANGE, (OPTIONAL)

PIN, MA1035B (4)

BEARING, MA217.. (2)

RING, B1048L

SCREW, MA996E (3)

WASHER, B1504BX

SHAFT ASS'Y, 1015424
* SHAFT, 1015423
BALL, MA1034H

RING, M26930 (2)

RING, B1048BD (2)

BEARING ASS'Y, 1015477 (2)
CONE ASS'Y, MA585HK
CUP, MA590FD

SHAFT, 1015285

RING, A2915CL

BEARING, 1015512

RING, MA994F

CAPSCREW, MA961C (4)

WASHER, M2081E (4)

PAN ASS'Y., 1015503
PAN, 1015502
CAGED NUT, MA1054B (4)

SHIM, 1015515
SHIM, 1015516
SHIM, 1015517
— AS REQ'D SEE NOTE #7

WASHER, B1504GD

CAPSCREW, MA1046B (3)

FLANGE, 1015525

CARRIER, 1015501

BEARING ASS'Y, 1015479
CONE ASS'Y, MA585HR
CUP, MA590FC

CAPSCREW, MA1041C (8)

RING, A2916JN

SHIM, 1015519
SHIM, 1015520
SHIM, 1015521
— AS REQ'D SEE NOTE #6 - B

PLUG, MA1040B

BEARING ASS'Y, 1015478
CONE ASS'Y, MA585HL
CUP, MA590DT

ASSEMBLE OIL SEAL AS SHOWN.

CAPSCREW, MA961A (2)
SEE NOTE #8

PLATE, 1015455

SEAL, M201576A

VIEW E-E
(3X = 1.00)

HOUSING ASS'Y, 1015523
* HOUSING, 1015522
BA__, MA1034J (2)
CAPSCREW, MA960D (2)
TUBE, 1015529
WASHER, M2081D (2)
CLAMP ASS'Y., 1015556
* CLAMP, 1015553
CAGED NUT, MA1054A (2)

FOR 1016001 UNIT	FOR 1017614 UNIT
GEAR, 1015283 6.04:1 RATIO, 145T	GEAR, 1017626 5.04:1 RATIO, 141T
GEAR, 1015351 5.04:1 RATIO, 141T	GEAR, 1017627 4.03:1 RATIO, 133T
GEAR, 1015284 4.03:1 RATIO, 133T	GEAR, 1017628 3.50:1 RATIO, 130T
GEAR, 1015354 3.50:1 RATIO, 130T	GEAR, 1015357 2.98:1 RATIO, 125T
GEAR, 1015357 2.98:1 RATIO, 125T	GEAR, 1015362 2.53:1 RATIO, 119T
GEAR, 1015362 2.53:1 RATIO, 119T	

HOUSING, MA029

SPRING, A2706AC

BALL, MA1034C

CAPSCREW, MA960E (2)

WASHER, MA1039A (2)

VIEW A-A
(5X = 1.00)

FOR MECHANICAL VALVE UNIT
ADAPTER, B2376

RING, A2669AP

MECHANICAL VALVE

ELECTRIC VALVE

PIN, MA1035A (2)

ADAPTER, 1015291

CAPSCREW, MA1042D (3)

COUPLING ASS'Y, DRIVE XB2375
* COUPLING, B2375
PIN, M1927CZ

VIEW B-B
(2X = 1.00)

FOR ELECTRIC VALVE UNIT
ADAPTER ASS'Y., 1017648
ADAPTER, 1017647
ROLLPIN, M1927AH

TUBE, 1015528

RING, M1904EE (2)

FOR 1016001 UNIT	FOR 1017614 UNIT
GEAR, 1015452	GEAR, 1017624

RING, M1904D (4)

B-B

BACKPLATE, 1015451 (2)

RING, A2915CJ (2)
ASSEMBLE TAPERED EDGE SIDE AWAY FROM BEARING.

SHAFT ASS'Y., 1015431
* SHAFT, 1015430
BALL, MA1034H

PISTON, 1015368 (2)

NOTE
THIS VIEW SHOWS THE PUMP ARRANGEMENT USED WITH THE MECHANICAL VALVE WITHOUT THE PUMP SPACER. USED WITH ASSEMBLY 1016001 ONLY. (SEE SHEET 2)

B-B

NOTE
THIS VIEW SHOWS THE PUMP SPACER AS USED WITH THE ELECTRIC VALVE.
USED WITH ASSEMBLY 1017614 AS STANDARD AND WITH ASSEMBLY 1016001 AS OPTIONAL (SEE SHEET 2)

FITTING, M1275

SEAL, 1015513 (2)

ASSEMBLE OIL SEALS AS SHOWN

VIEW D-D
(2X = 1.00)

PLATE, 206200 (26)

PLATE, 206238B (24)

RETAINER, 1015454 (2)

SPRING A2705AU (28)

RING, MA994F (2)

RING, M2693R (2)

RING, M1904GM (2)

VIEW C-C
(5X = 1.00)

GEAR RATIOS:

1015239

TORQUE-TRANSMISSION

1016001
1017614

MG 5600 MARINE TRANSMISSION

FOR 1016001 UNIT

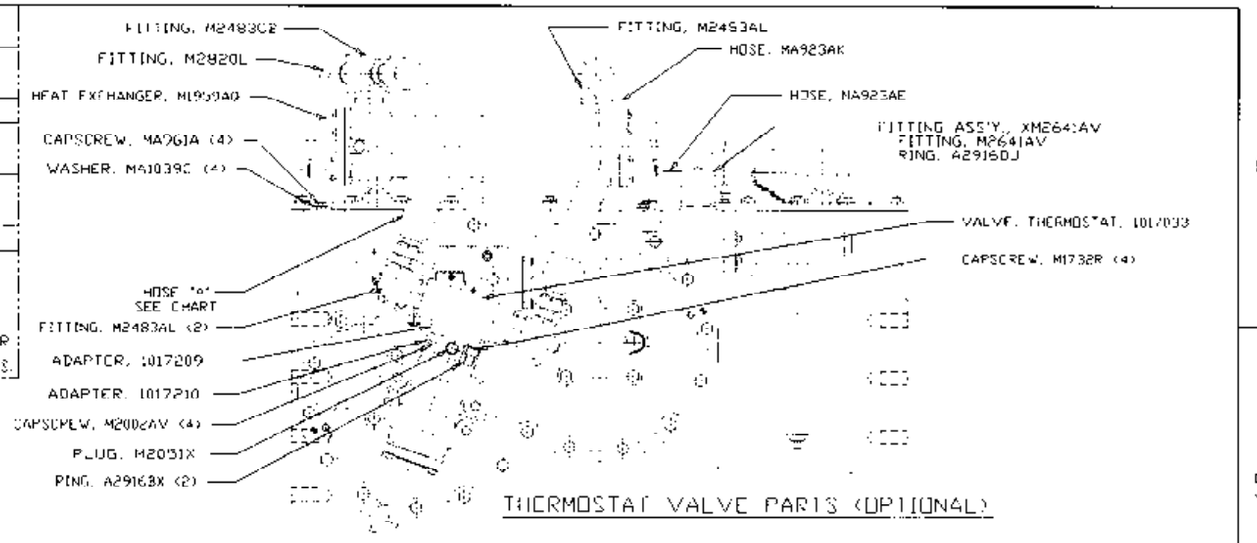
	ENGINE ROTATION	ENGINE FULL LOAD GOVERNED SPEED - R.P.M.		
		900 - 1299	1300 - 1699	1700 - 2100
PUMP	RH	1016698	1016699	1016700
	LH	1016701	1016702	1016703
SUCTION TUBE (MECHANICAL VALVE)	RH	1016668	1016668A	1016668B
	LH	1016670	1016670A	1016670B
SUCTION TUBE (ELECTRIC VALVE)	RH	1017609	1017609A	1017609B
	LH	1017611	1017611A	1017611B
HOSE 'A' (MECHANICAL VALVE)		MA923AE	MA923AE	MA923AE
HOSE 'B'✱(MECHANICAL VALVE)		MA923AF	MA923AF	MA923AF
HOSE 'A' (ELECTRICAL VALVE)		MA923AG	MA923AG	MA923AG
HOSE 'B'✱(ELECTRICAL VALVE)		MA923AG	MA923AG	MA923AG

✱THESE HOSES ARE USED WITHOUT THERMOSTAT VALVE. WHEN OPTIONAL THERMOSTAT VALVE IS USED SEE HOSE CALLOUT IN OPTIONAL VIEW AT RIGHT. ALSO SEE OTHER BOXED AREAS FOR OTHER DIFFERENCES BETWEEN MECHANICAL & ELECTRIC VALVES.

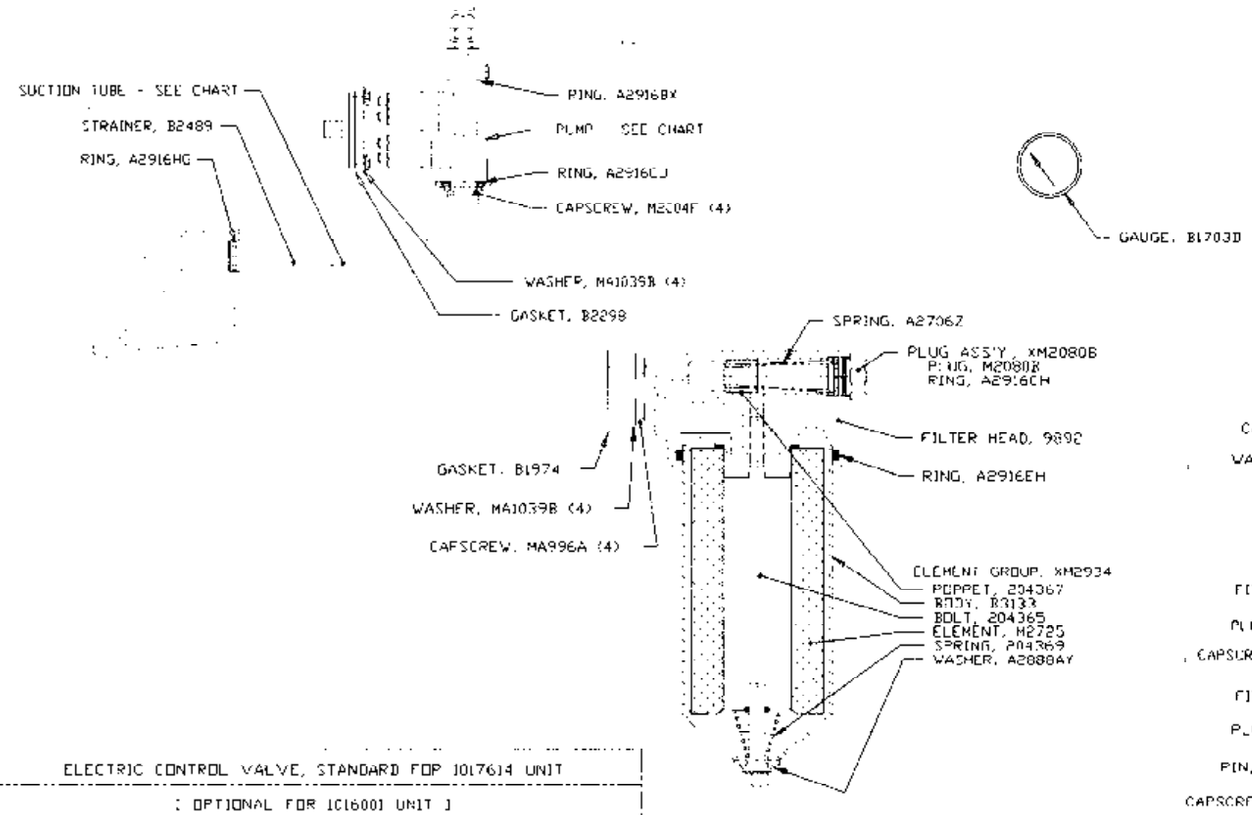
FOR 1017614 UNIT

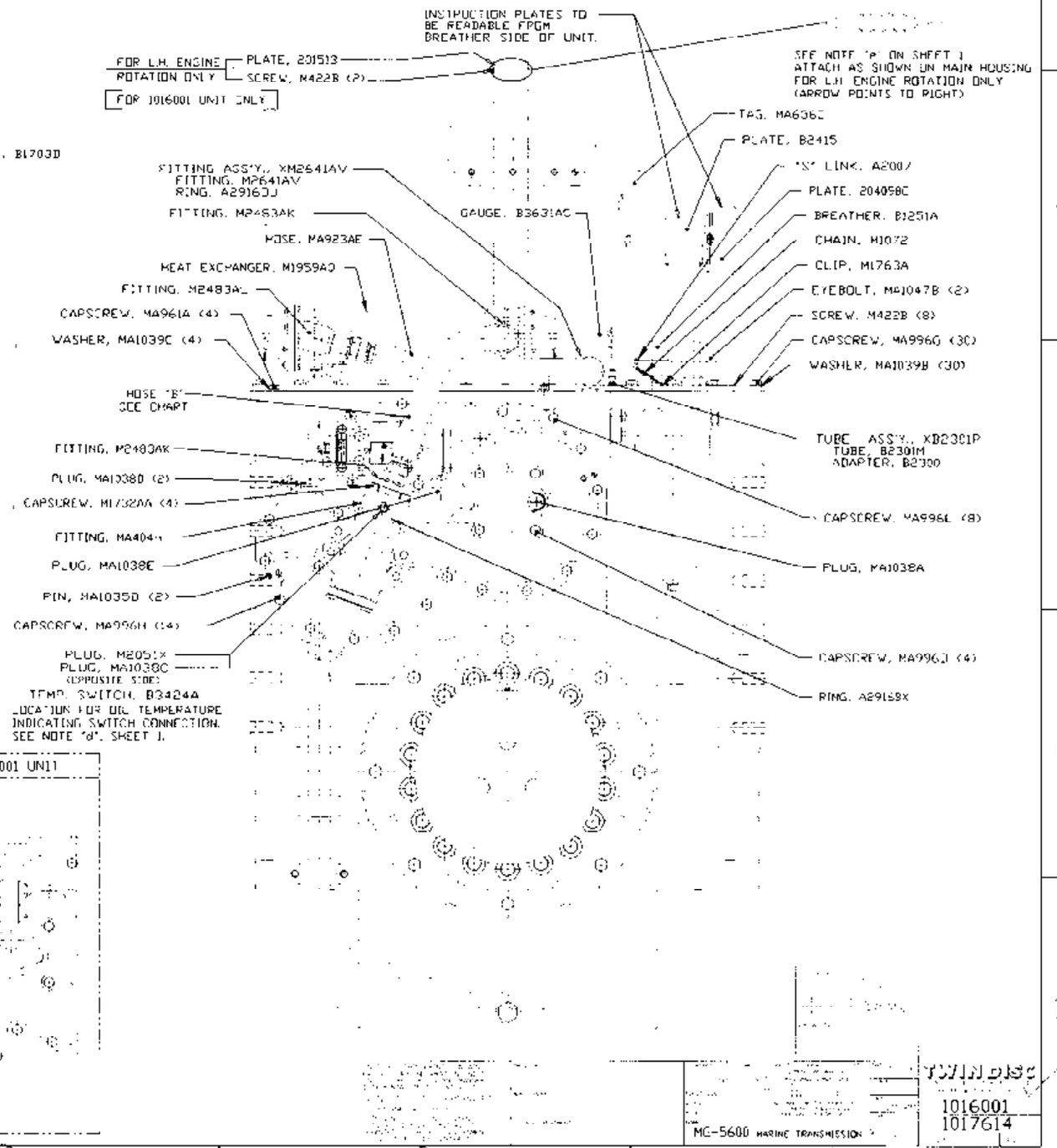
	ENGINE FULL LOAD GOVERNED SPEED - R.P.M.		
	900 - 1299	1300 - 1699	1700 - 2100
PUMP	1016698	1016699	1016700
SUCTION TUBE	1017609	1017609A	1017609B
HOSE 'A'	MA923AG	MA923AG	MA923AG
HOSE 'B' ✱	MA923AG	MA923AG	MA923AG

✱THESE HOSES ARE USED WITHOUT THERMOSTAT VALVE. WHEN OPTIONAL THERMOSTAT VALVE IS USED SEE HOSE CALLOUT IN OPTIONAL VIEW AT RIGHT. ALSO SEE OTHER BOXED AREAS FOR OTHER DIFFERENCES BETWEEN MECHANICAL & ELECTRIC VALVES.



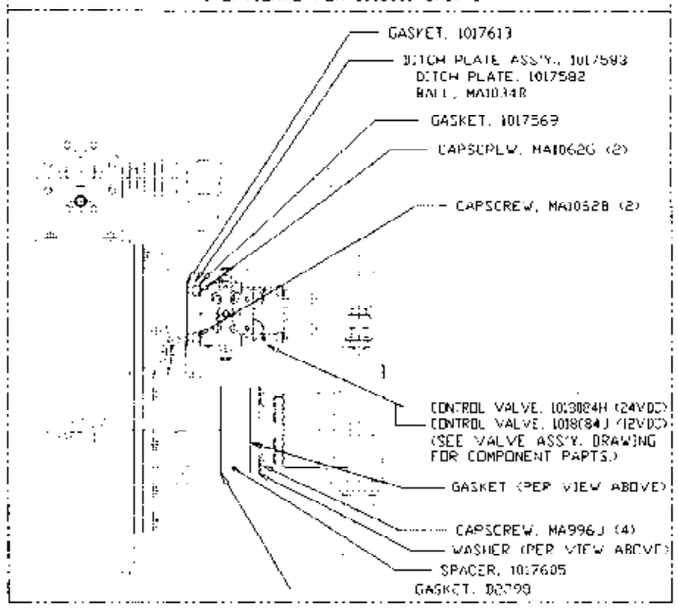
THERMOSTAT VALVE PARTS (OPTIONAL)



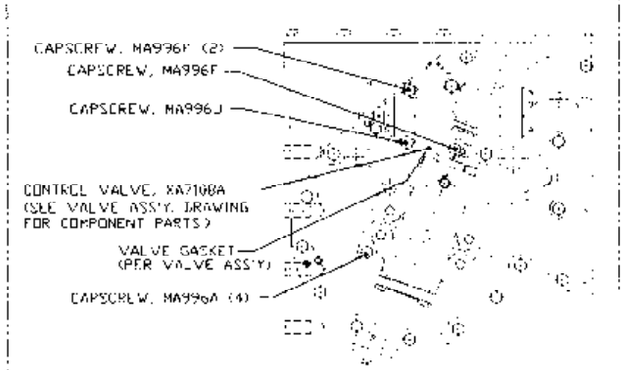


ELECTRIC CONTROL VALVE, STANDARD FOR 1017614 UNIT

(OPTIONAL FOR 1016001 UNIT)



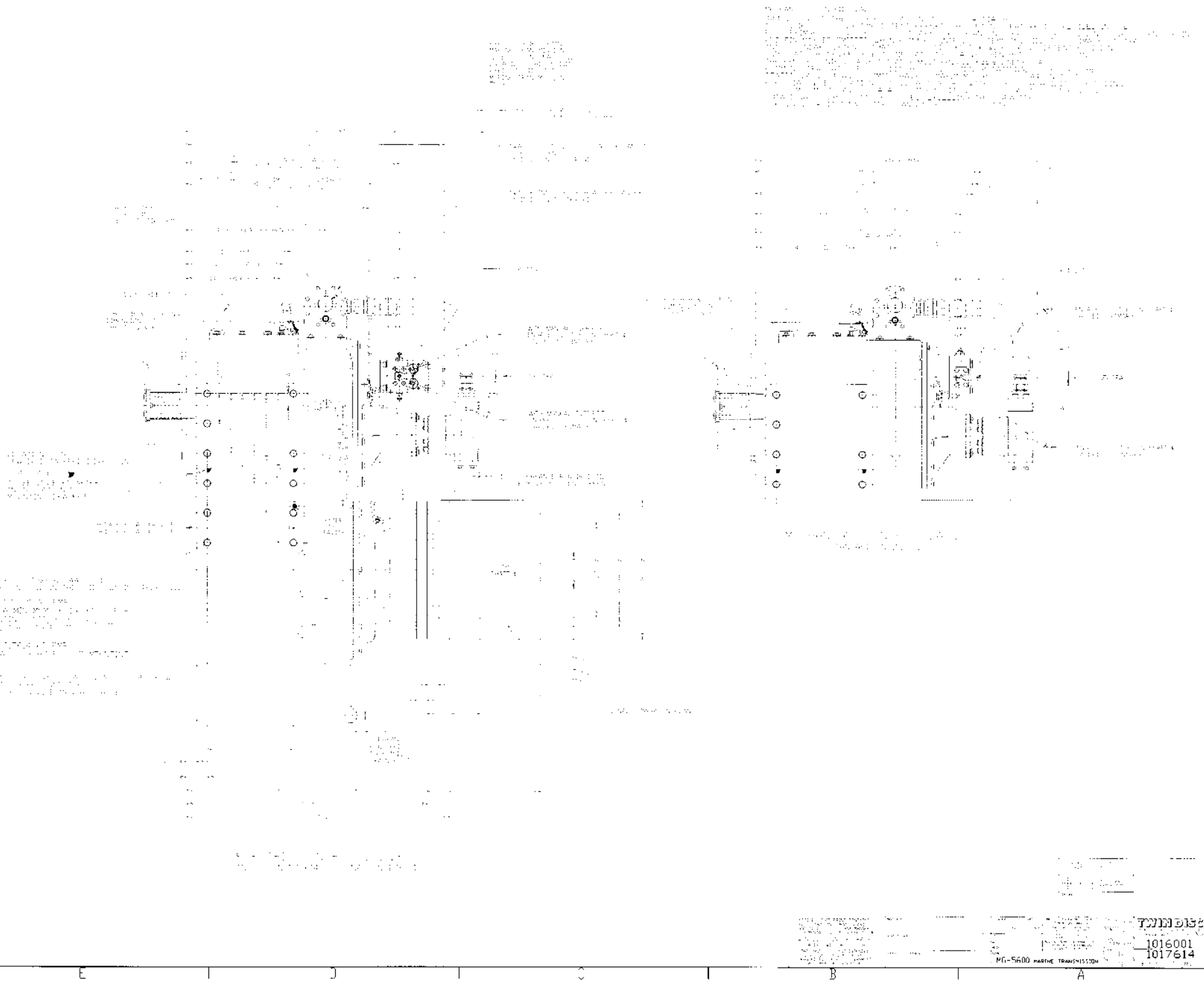
MECHANICAL CONTROL VALVE, STANDARD FOR 1016001 UNIT



TWIN DISC

1016001
1017614

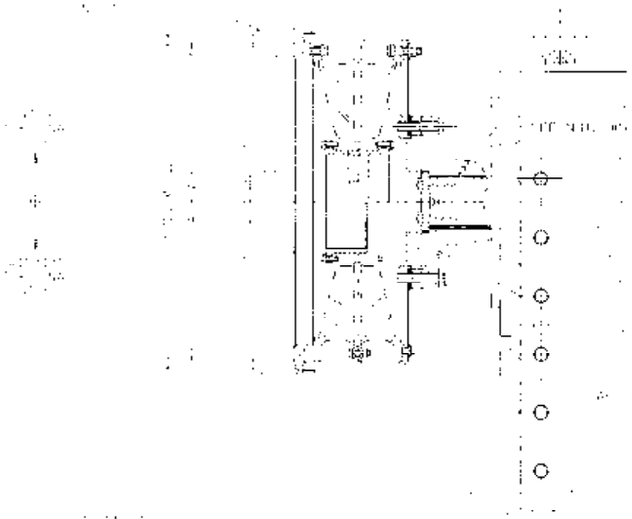
MG-5600 MARINE TRANSMISSION

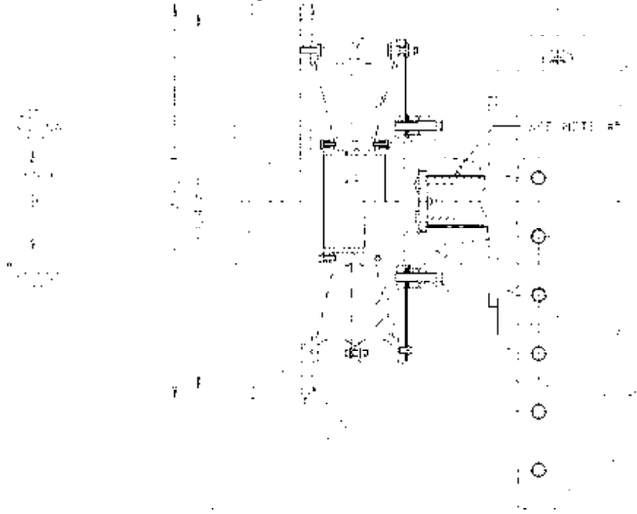


TWIN DISC
1016001
1017614
MG-5600 MARINE TRANSMISSION

ELECTRIC CONTROL VALVE

MECHANICAL CONTROL VALVE

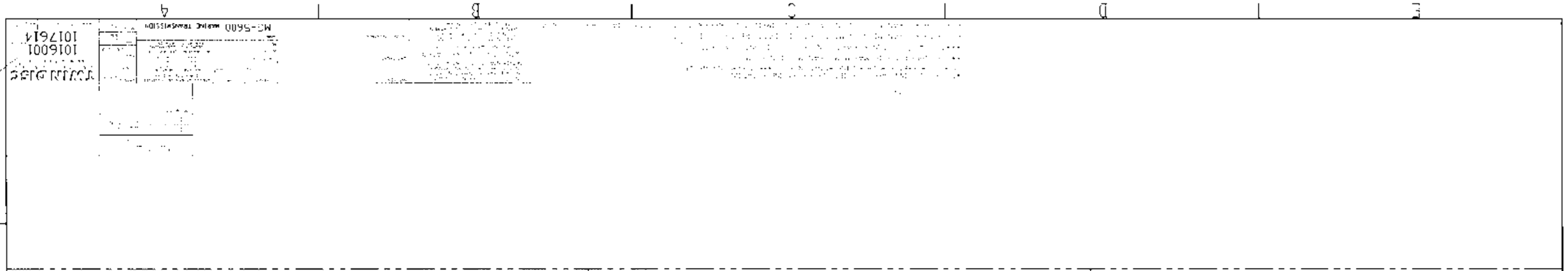


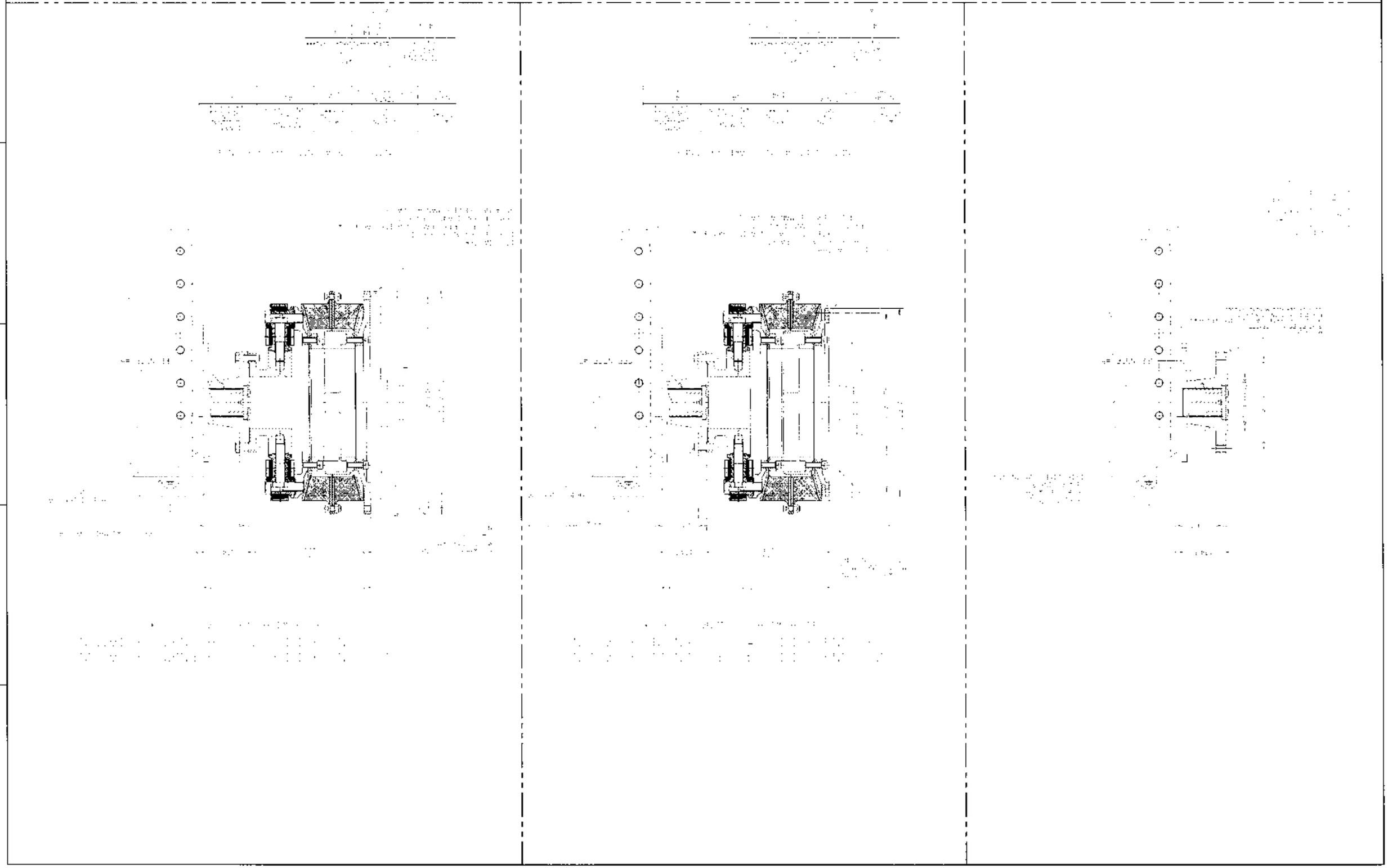


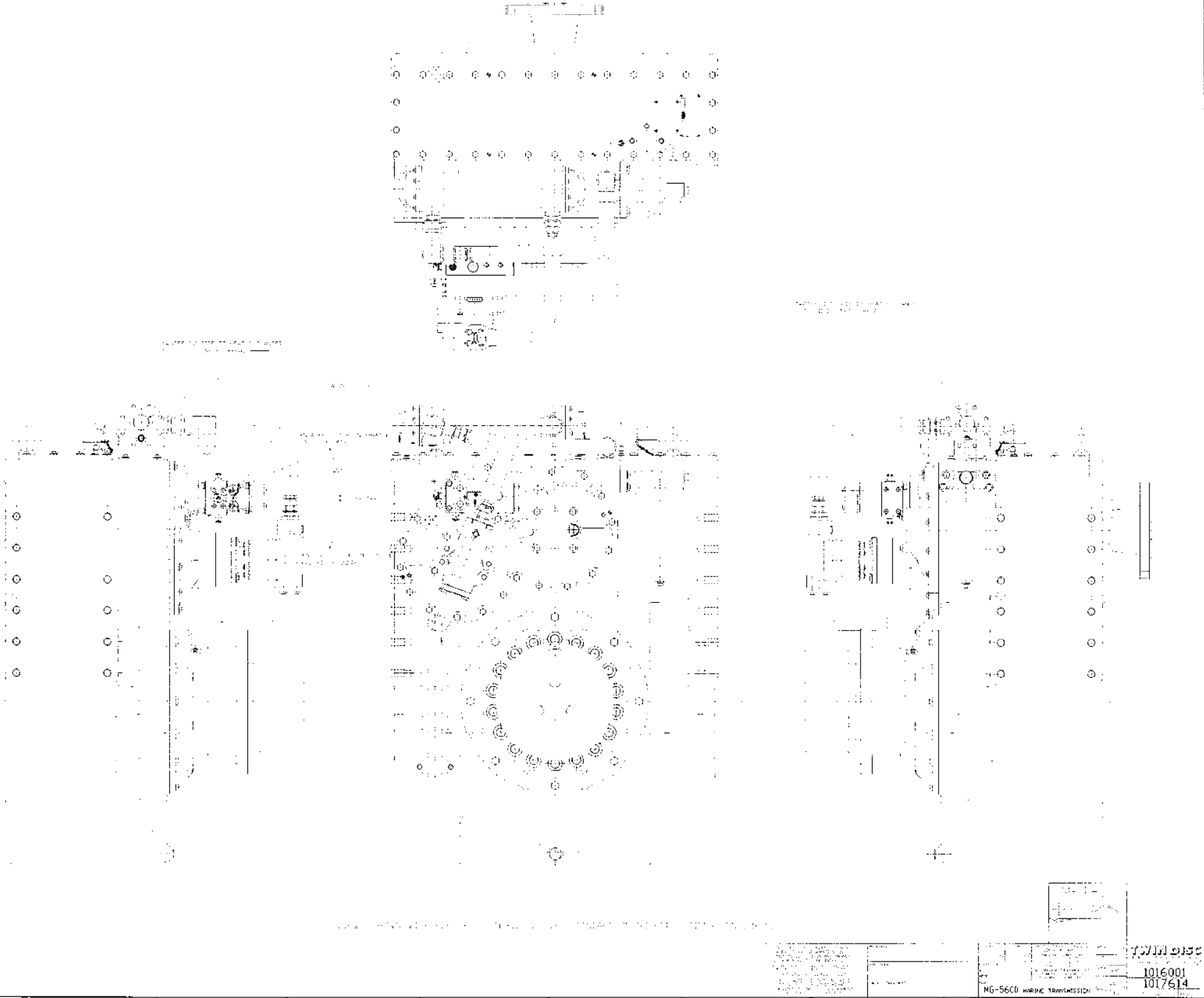
TWIN DISC

1016001
1017614

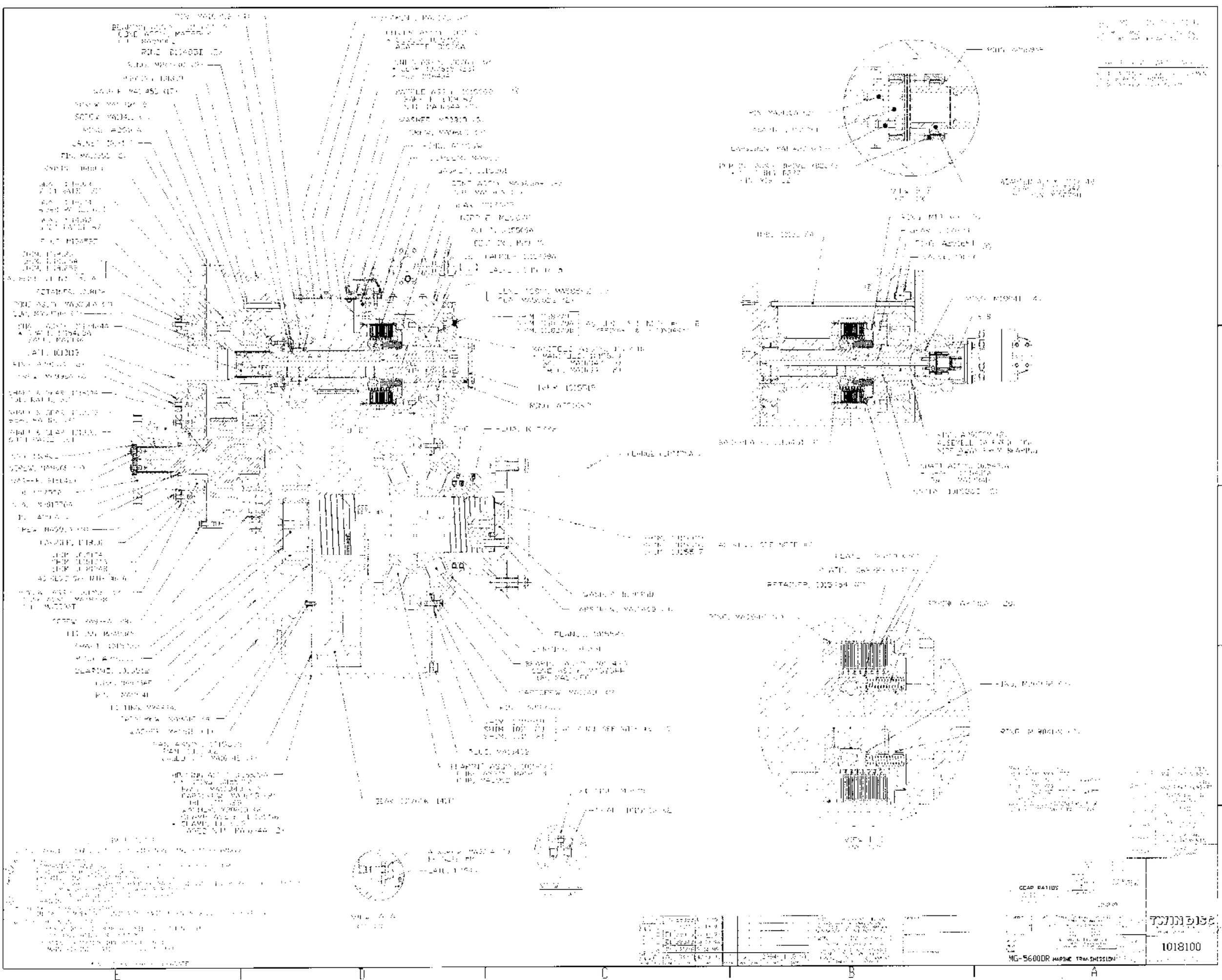
MG-5600 MARINE TRANSMISSION







TWIN DISC
1016001
1017614
MG-5600 MARINE TRANSMISSION

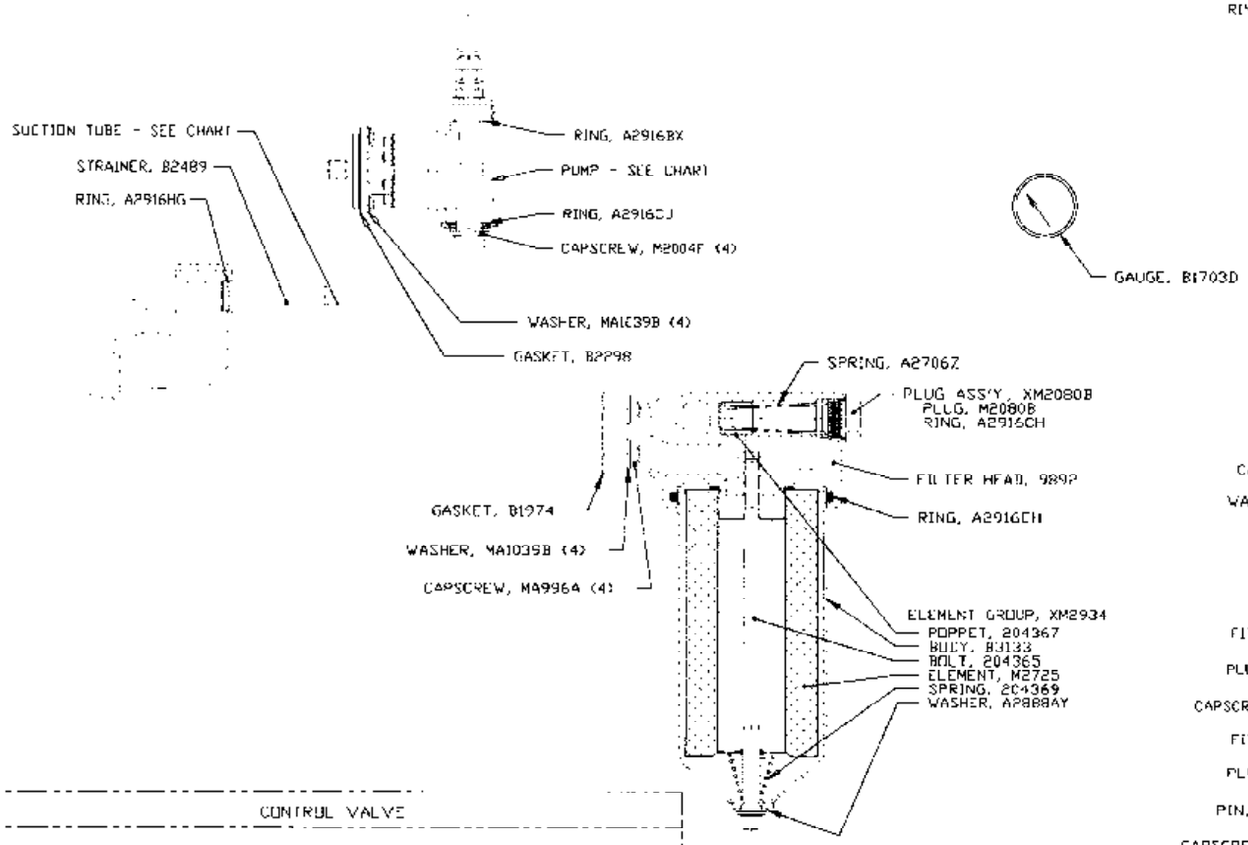


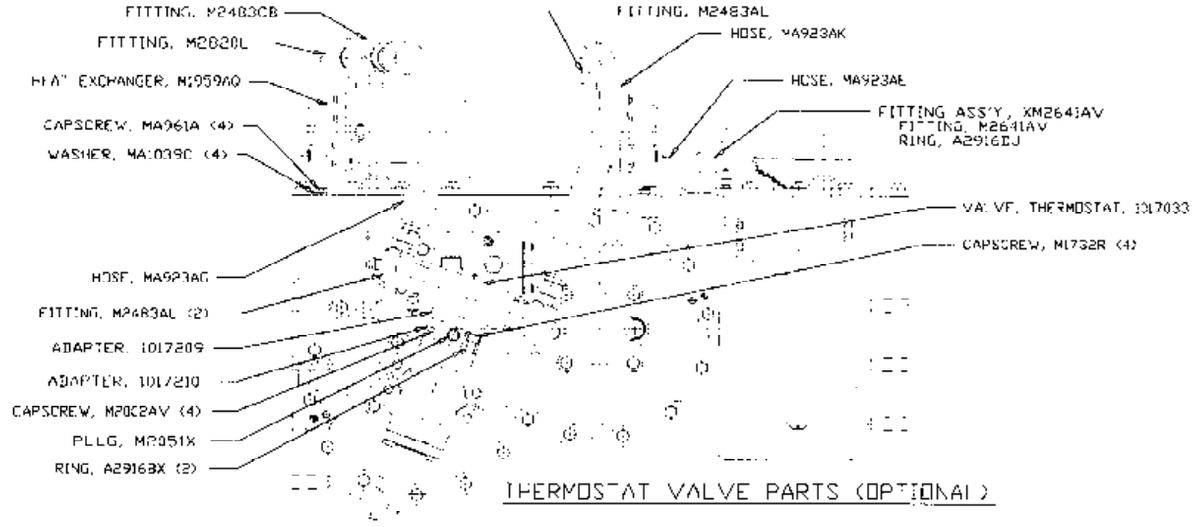
GEAR RATIOS

1018100

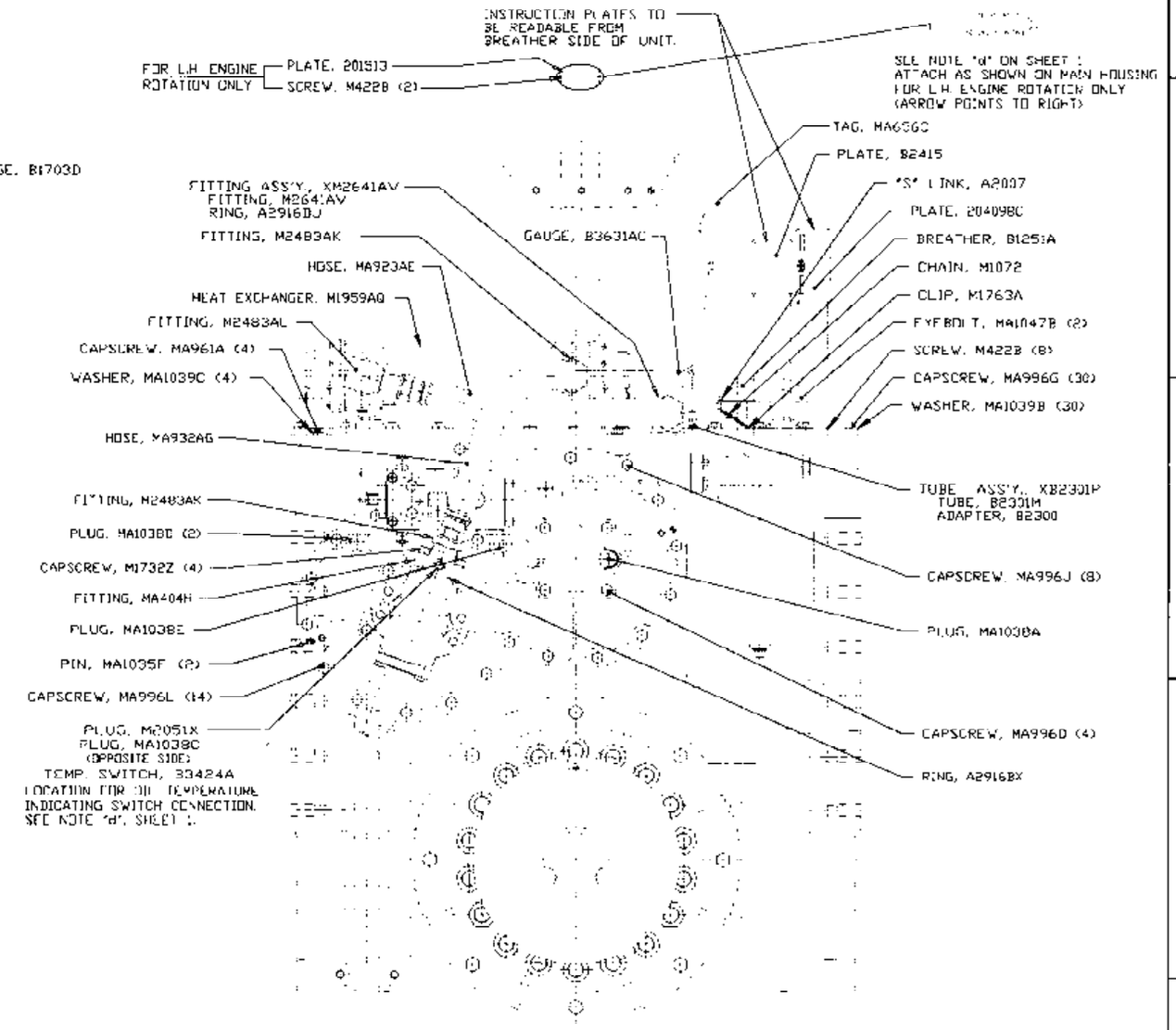
MG-5600DR MARINE TRANSMISSION

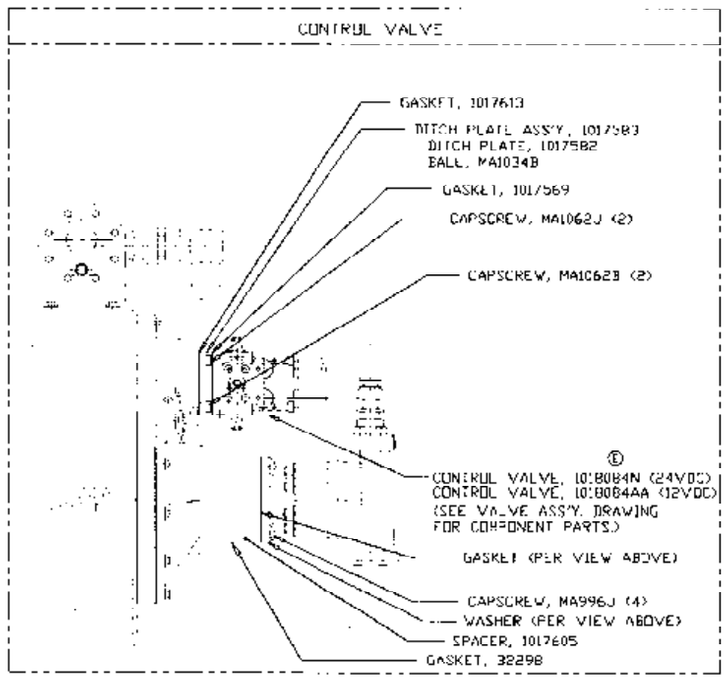
	ENGINE ROTATION	PART NO.
PUMP	RH	1016702
	LH	1016699
SUCTION TUBE (ELECTRIC VALVE)	RH	1017611
	LH	1017609





THERMOSTAT VALVE PARTS (OPTIONAL)

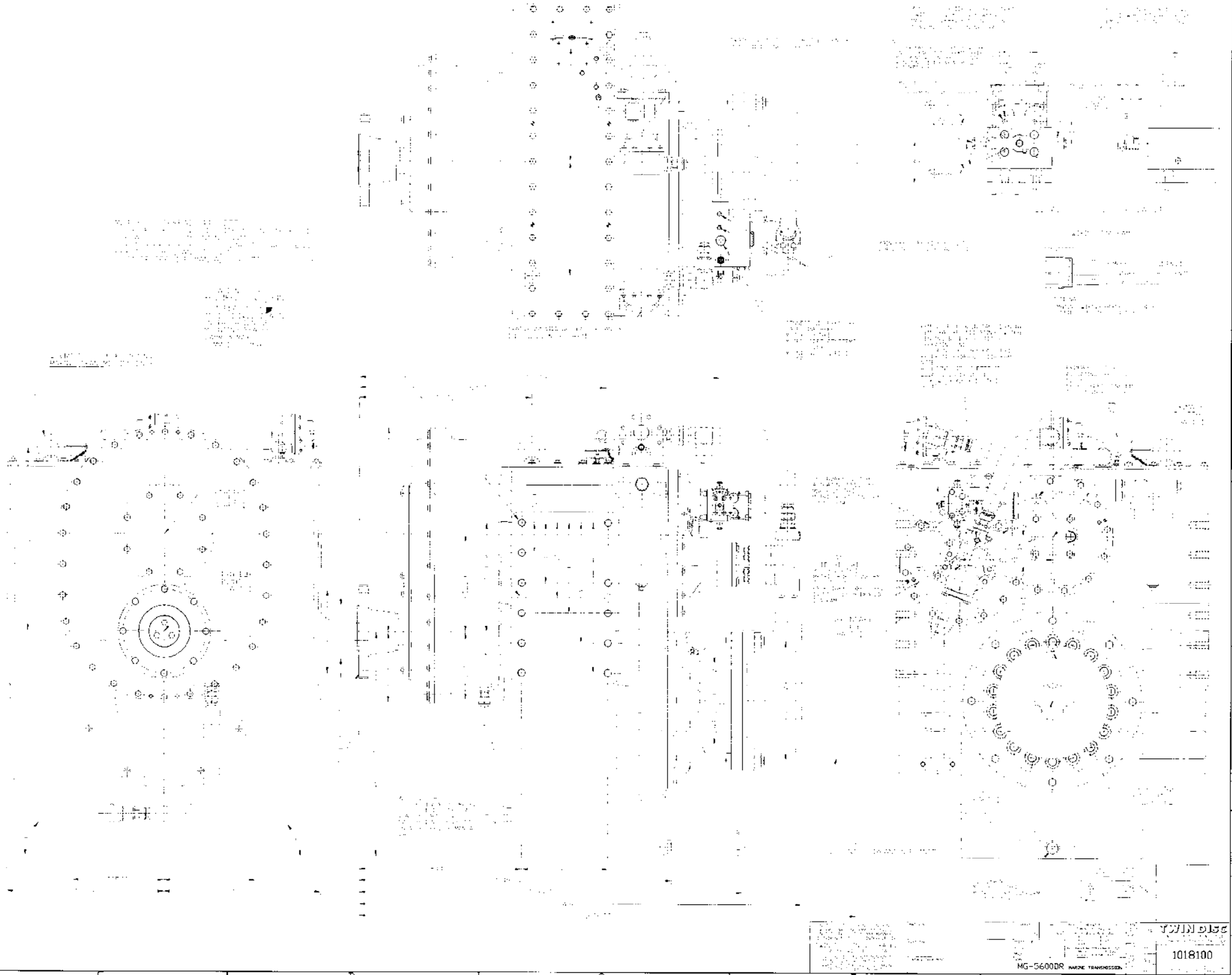




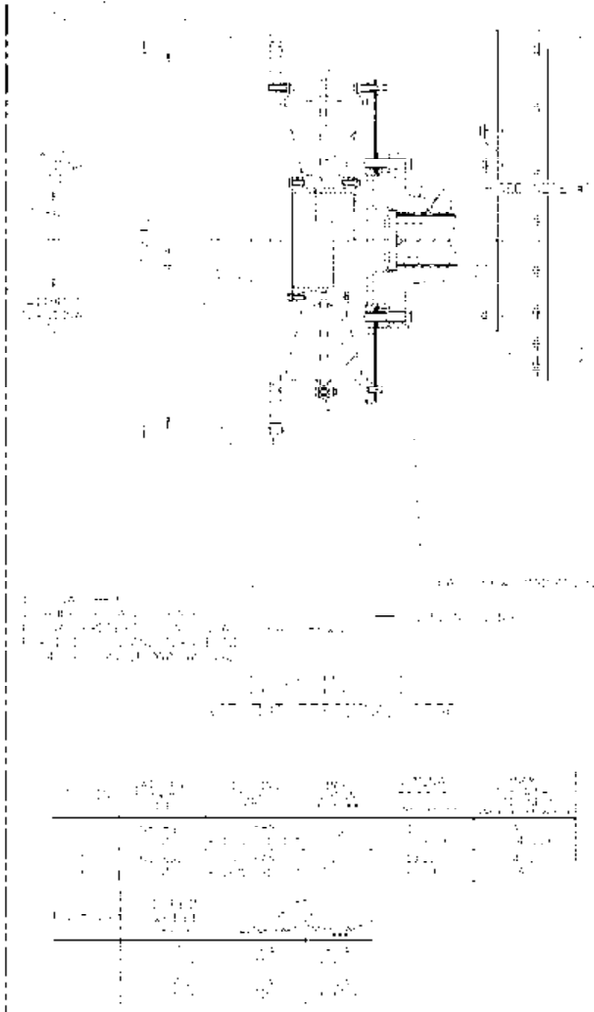
TWIN DISC

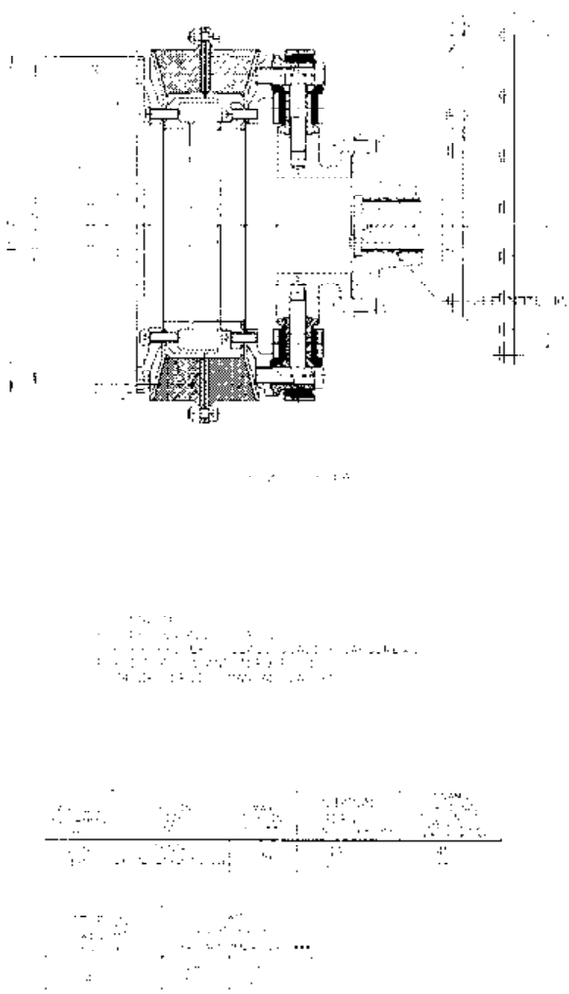
1018100

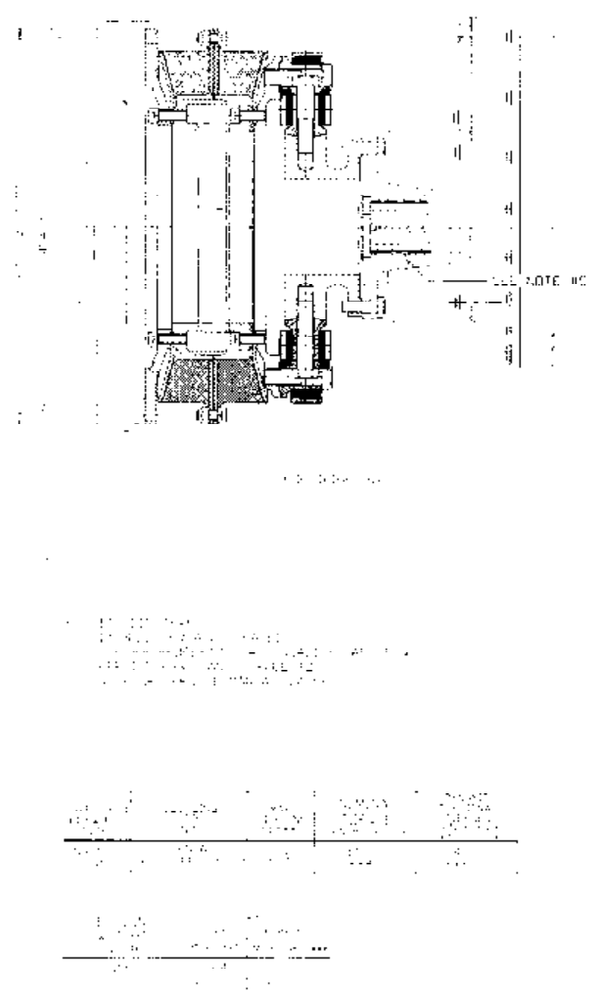
MG-5600DR MARINE TRANSMISSION

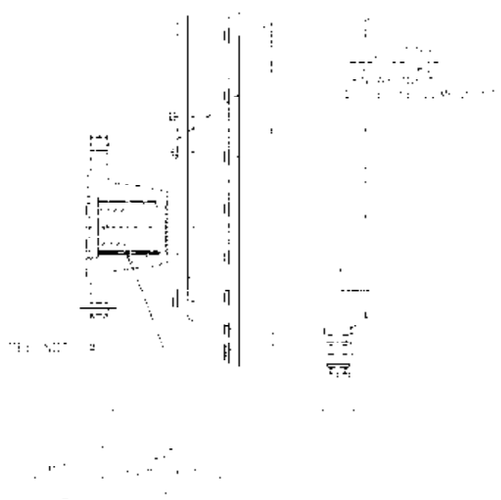


TWIN DISC
1018100
MG-5600DR MARINE TRANSMISSION

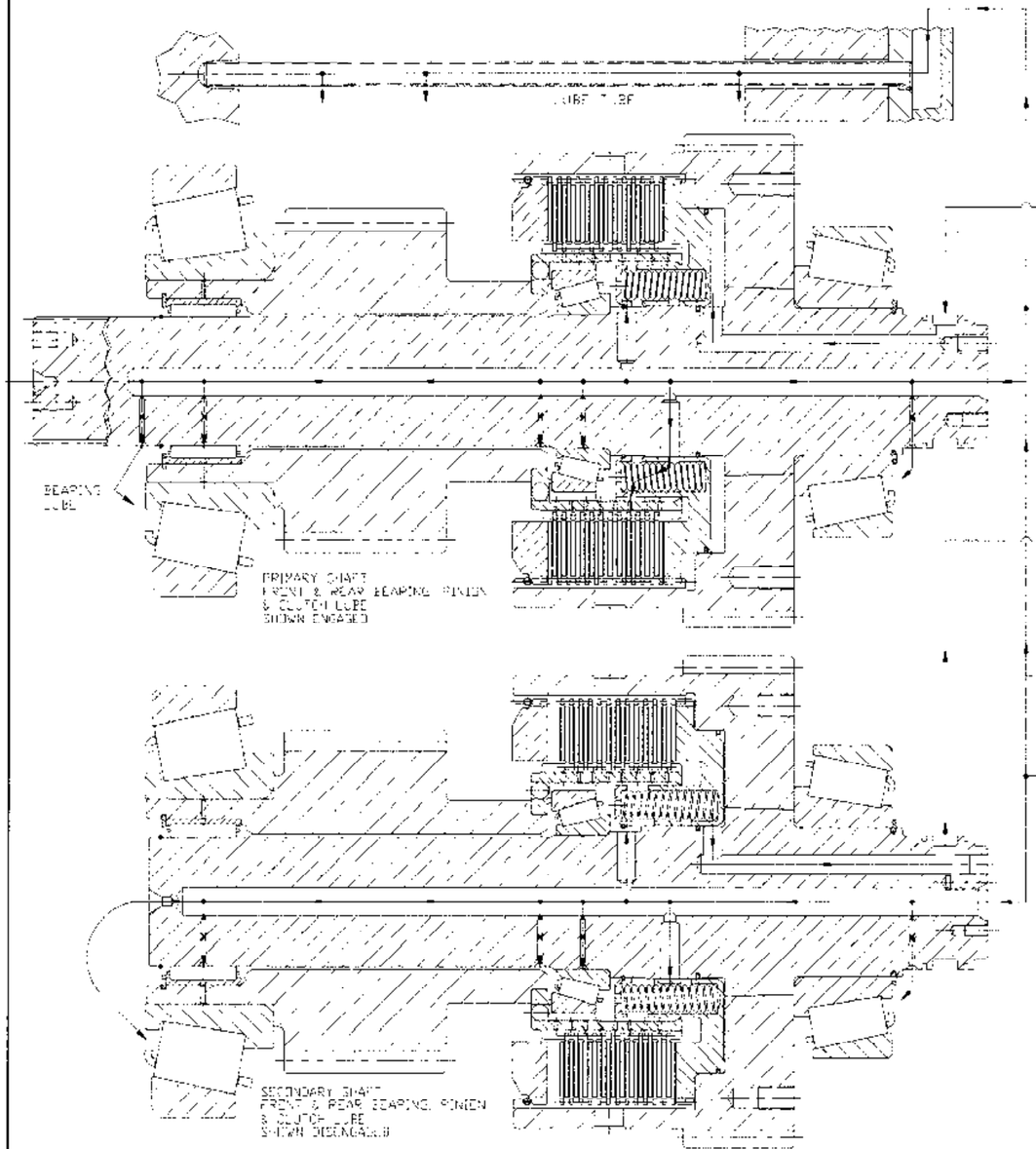


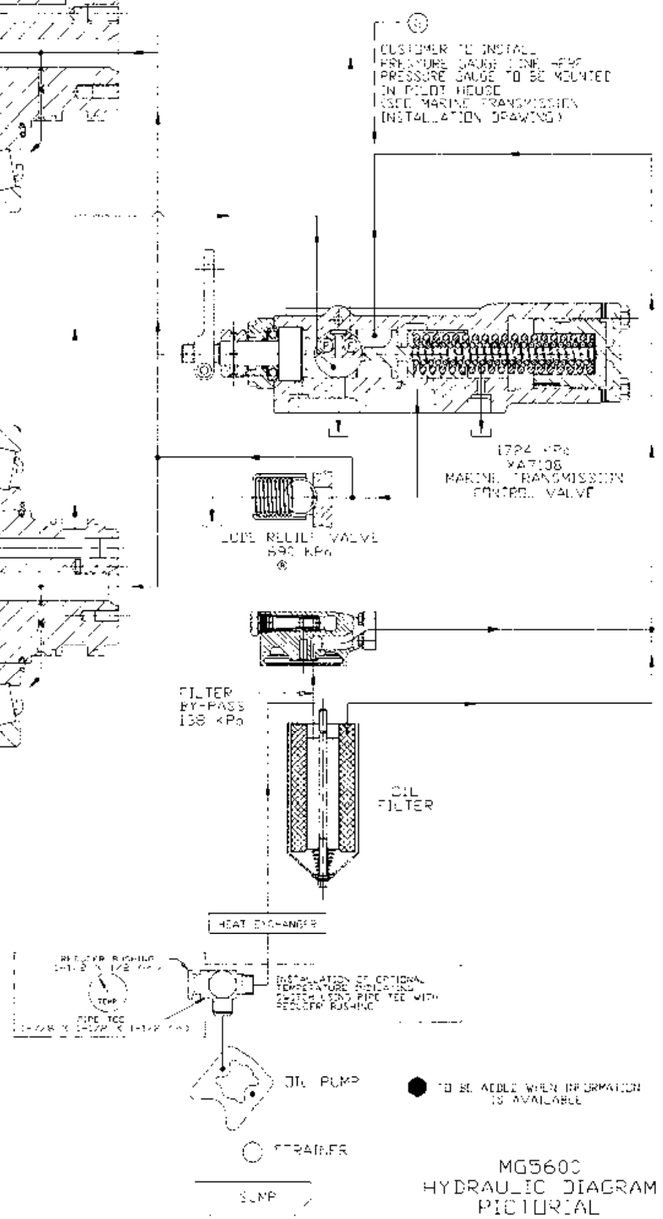




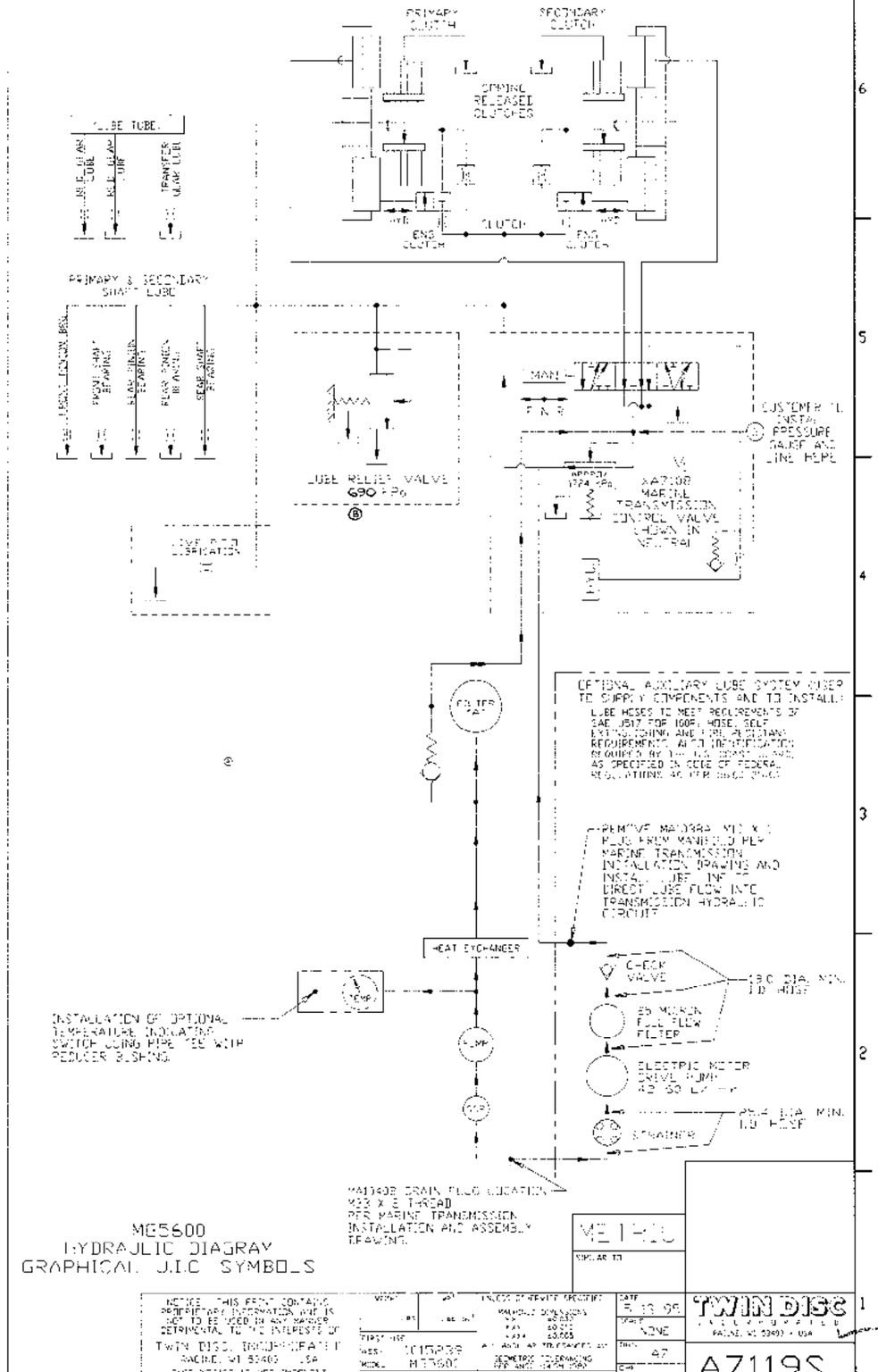


1018100
MC 5GC0DR MARINE TRANSMISSION





MG5600
HYDRAULIC DIAGRAM
PICTURIAL



MG5600
HYDRAULIC DIAGRAM
GRAPHICAL J.I.C. SYMBOLS

REV	ZONE	CH. NO.	DATE
B	F-4	250490	1-25-99
A	E-3, E-4	240341	1-01-96

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UNLESS OTHERWISE SPECIFIED
MACHINED SURFACES ±0.25
CASTINGS ±0.51
FORGINGS ±0.76
ALL ANGLES ±0.5 DEGREES
GEOMETRIC TOLERANCING PER ANSI Y14.5M-1982

DRAWN BY: JP
TRACED BY: LEE WHT
FIRST USED ON: 1015P39
CHECKED BY: MG
MODEL: MG5600
NAME: DIAGRAM - HYDRAULIC

DATE: 5-10-95
SHEET: NONE
SIZE: A7
SCALE: NTS
APPD: DJS

TWIN DISC
INCORPORATED
RACINE, WI 53403 • USA

A7119S

SHEET 1 OF 1 REV. B

F E D C B A

LUBE TUBE

SECONDARY SHAFT
FRONT & REAR BEARING, PINION
& CLUTCH LUBE
SHOWN DISENGAGED

BEARING LUBE

OIL LEVEL

PRIMARY SHAFT
FRONT & REAR BEARING, PINION
& CLUTCH LUBE
SHOWN ENGAGED

CUSTOMER TO INSTALL
PRESSURE GAUGE LINE HERE
PRESSURE GAUGE TO BE MOUNTED
IN PILOT HOUSE.
(SEE MARINE TRANSMISSION
INSTALLATION DRAWING)

NOTE: Optional electric/manual control valve 1018084 is available. Reference A/II9W valve hydraulic diagram.

2000 kPa
1017172
MARINE TRANSMISSION
CONTROL VALVE

LUBE RELIEF VALVE
827 kPa

OPTIONAL LIVE P.T.O.
REF. ASSEMBLY NO. 1016038

FILTER
BY PASS
138 kPa

OIL
FILTER

HEAT EXCHANGER

REDUCER BUSHING
1-1/2 X 1/2 (NPT)

TEMP

PIPE TEE
(1-1/2 X 1-1/2 X 1-1/2 (NPT))

INSTALLATION OF OPTIONAL
TEMPERATURE INDICATING
SWITCH USING PIPE TEE WITH
REDUCER BUSHING

OIL PUMP

STRAINER

SUMP

MG-5600DR
HYDRAULIC DIAGRAM
PICTORIAL

LUBE TUBE

RED GEAR TUBE

RED GEAR LUBE

TRANSFER GEAR LUBE

SECONDARY SHAFT LUBE

FRONT PINION BRG.

FRONT SHAFT BEARING

REAR PINION BEARING

REAR PINION BEARING

REAR SHAFT BEARING

PRIMARY SHAFT AND
REDUCTION GEAR LUBE

REDUCTION GEAR CASE

FRONT PINION BRG.

FRONT SHAFT BEARING

REAR PINION BEARING

REAR PINION BEARING

REAR SHAFT BEARING

LIVE P.T.O.
LUBRICATION

PRIMARY CLUTCH

SECONDARY CLUTCH

SPRING RELEASED CLUTCHES

HYD

ENG CLUTCH

CLUTCH

HYD

ENG CLUTCH

LUBE RELIEF VALVE
827 kPa

MAN.

F N R

CUSTOMER TO INSTALL PRESSURE GAUGE AND LINE HERE.

APPROX. 2000 kPa

V1
1017172
MARINE TRANSMISSION
CONTROL VALVE
SHOWN IN
NEUTRAL

HYD

OPTIONAL AUXILIARY LUBE SYSTEM (USER TO SUPPLY COMPONENTS AND TO INSTALL)
LUBE HOSES TO MEET REQUIREMENTS OF SAE J517 FOR 100R1 HOSE; SCUF, EXTINGUISHING AND FIRE RESISTANT REQUIREMENTS, ALSO IDENTIFICATION REQUIRED BY THE U.S. COAST GUARD, AS SPECIFIED IN CODE OF FEDERAL REGULATIONS 46 CFR 56.60 15(c).

FILTER

REMOVE MA1038A, M10 X 1 PLUG FROM MANIFOLD PER MARINE TRANSMISSION INSTALLATION DRAWING AND INSTALL LUBE LINE TO DIRECT LUBE FLOW INTO TRANSMISSION HYDRAULIC CIRCUIT

HEAT EXCHANGER

CHECK VALVE

19.0 DIA. MIN. I.D. HOSE

25 MICRON FULL FLOW FILTER

ELECTRIC MOTOR DRIVE PUMP
42-60 L/ m n

PUMP

SCR

25.4 DIA. MIN. I.D. HOSE

STRAINER

INSTALLATION OF OPTIONAL TEMPERATURE INDICATING SWITCH USING PIPE TEE WITH REDUCER BUSHING.

MA1040B DRAIN PLUG LOCATION M33 X 2 THREAD PER MARINE TRANSMISSION INSTALLATION AND ASSEMBLY DRAWING.

MG-5600DR
HYDRAULIC DIAGRAM
GRAPHICAL J.I.C. SYMBOLS

REV	DATE	CH NO	BY	REV	DATE	CH NO	BY

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DESIGN	WT LBS
	LBS IN²
FIRST USE	
ASSY 1018100	
MODEL MG 5600DR	
NAME	DIAGRAM, HYDRAULIC

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
XX ±0.030
XXX ±0.010
XXXX ±0.002
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

DRWN	3-27-98
SCALE	NONE
CHK	BJE
APPD	DAS

TWIN DISC INCORPORATED RACINE, WI 53403 - USA

A7119X

SHEET 1 OF 1 REV ---

METRIC

SINCLAIR "D"

Notes

Drawn: ALC/BJE Checked: DAS Approved: TBC	ASSEMBLY INSTRUCTIONS (CHECKS AND TESTS) AND PRODUCTION TESTS, MARINE TRANSMISSION MG-5600 (ASSEMBLIES 1015239, 1016001 & 1017614)	
	Original Issue Date: 04-10-95 Latest Issue Date: 09-26-00 ECN: 30339	PROCEDURE

The unit is to pass all these checks and tests before being approved for shipment.
Please follow your routing instructions carefully. The routing contains additional information to assist you in determining when it is best to apply each check and test and it also offers additional guiding instructions.

I. ASSEMBLY INSTRUCTIONS

Assembly check limits are given in section V.

1. Unless otherwise specified:
   - A. Degrease surfaces of taper bores and their mating shaft seats per S765 "Assembly Instructions" before assembly.
   - B. All bolts, screws and nuts are to be "as received" from bins with only light rust preventative oil on them and torqued per S574.
   - C. The main housing should be oriented with the SAE (flywheel) housing down during the installation of the shaft assemblies.
   - D. Splines only may be lubricated with white lead or molydisulphide treated lubricants.

2. Transfer Driving and Driven Gears Taper Joint Assembly:
   Joint surfaces to be in condition described in I.1.A. Place gears on shafts using 445 - 890 N (100 - 200 lbf) max. force to seat them on their tapers. Advance each gear. A static pressure of approximately 569 - 738 kN (64 - 83 tons) will be required.

   For primary and secondary shaft assemblies, advance gear within 0.00 - 0.05 mm (.000 - .002 in) of the shaft shoulder at the small diameter end of the taper, and record advance.

3. Output Gear Taper Assembly:
   Joint surfaces to be in condition described in I.1.A. Coat the tapered surfaces with thin oil. Install cylindrical roller bearing outer race/roller assembly, along with snap ring, into main housing. Use suitable "C" type lift fixture to position gear into correct position. Install cylindrical roller bearing inner race and snap ring onto output shaft. Install the output shaft assembly thru the gear bore and into the cylindrical roller bearing outer race/roller assembly. Connect oil injection equipment assembly tool.

   Use portable press (890 kN [100 ton] capacity) and fixture to seat gear using 1340 N (300 lbf) load. Inject oil with a viscosity of 300 mm^2/s (300 cSt) at the operating temperature into the shaft until it leaks out of both ends of the mating surfaces.

   Advance gear to shaft shoulder stop. Release injection oil pressure between the mating surfaces and wait 5 minutes before lowering the pull on force and removing the assembly tool. Record actual advance.

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4. Output Flange Taper Assembly:
Joint surfaces to be in condition described in I.1.A. Coat the tapered surfaces with thin oil. Measure distance from output shaft end to taper roller bearing cone assembly face. Measure length of output flange hub taper. Note: With the output flange fully assembled the difference between these two measurements must equal the space available for shaft end shims within 0.05 mm (.002 in).

Install output flange onto output shaft along with retainer washer and screws. Connect oil injection equipment to output flange hub. Seat hub using 1340 N (300 lbf) load. Inject oil with a viscosity of 300 mm^2/s (300 cSt) at the operating temperature into the hub until it leaks out between the hub and shaft.

Continue injecting oil, while using retainer washer screws to advance flange to bearing stop. Release injection oil pressure between the mating surfaces and wait 5 minutes before removing screws and retainer washer. Record actual advance.

5. Splines:
The input spline for the "close-coupled" model (assembly 1015239) is a "loose" fit and should assemble without need to heat the internal spline. Press the input spline parts for the "free-standing" models (assemblies 1016001 and 1017614) together when cold or with internal spline part heated to 150°C (300°F) maximum.

6. Taper Roller Bearing Adjustment:
   A. Primary and secondary shaft bearings:
   Shim bearings with spacers and shim assemblies.
   Push-Pull bearing adjustment method:
   Shim tapered roller bearings per S692-IV A1 to the specified dial indicator endplay with all cover bolts fully torqued. Record endplay.

   B. Output shaft bearings:
   Push-Pull bearing adjustment method:
   Shim thrust bearings per S692IV.A1 using thrust force shown below.

	S692III THRUST
OUTPUT SHAFT	1340 - 4000 N (300 - 900 lbf)

7. Retainer Washer Shimming Procedure:
At output shaft: Determine the gap (flange face protruding beyond end of shaft). Measure gap and use shims 0.08 - 0.15mm (.003 - .006 in) thinner than gap. No record is required.

8. Input Hub-Coupling Joint Assembly and Input Shaft Centering Plate Screws:
Apply MA908 to the "as received" bolts just before assembly, and torque per S574.

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II. ASSEMBLY CHECKS (General)

1. Visually inspect housing and components for imperfections.

2. Backlash: Roll all gears to insure no binding. The expected backlash including housing tolerances is given below.

   Transfer Driving to Transfer Driven Gear: 0.15 - 0.28 mm (.006 - .011 in)

   Reduction Gears: 0.15 - 0.28 mm (.006 - .011 in)

3. Record total indicator runout of the following items specified in section V.

4. Recheck dipstick.

III. NAMEPLATE DATA

1. Oil Capacity: 110 L (29 gallons)

2. Minimum oil pressure ⊗ when cruising (non-trolling mode).

   1520 kPa (220 psi): 1725 kPa (250 psi) Control Valve
   1800 kPa (260 psi): 2000 kPa (290 psi) Control Valve

3. See shop order for bill of material and model numbers. Also apply serial number, ratio and customer number, when applicable.

IV PRODUCTION TESTING

Before approval for shipment, assembled units are to pass production tests. Limits for the production tests are provided in section VI.

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V. ASSEMBLY CHECK SHEET MG-5600

Model	BOM Number	Serial Number	Ratio	Assembly Date

Primary Transfer Gear Advance		
Minimum 3.33 mm (.131 in)	Actual	Maximum 4.29 mm (.169 in)

Secondary Transfer Gear Advance		
Minimum 3.33 mm (.131 in)	Actual	Maximum 4.29 mm (.169 in)

Output Gear Advance		
Minimum 11.86 mm (.467 in)	Actual	Maximum 13.54mm (.533 in)

Output Flange Advance		
Minimum 10.16mm (.400 in)	Actual	Maximum 12.35mm (.486 in)

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V. ASSEMBLY CHECK SHEET MG-5600

Primary Tapered Roller Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Secondary Tapered Roller Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Output Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Record total indicator runout of the following, max. allowable shown.	Actual
0.41mm (.016 in) face of SAE #0 & SAE #00 front housing from input spline.	
*0.30mm (.012in) pilot of SAE #0 & SAE #00 front housing from input spline.	
0.10mm (.004 in) face of propeller flange near O.D. from main housing.	
0.10mm (.004 in) pilot of propeller flange from main housing.	
* This note applies to a continuous 270° arc if the balance of the pilot is negative in readings; otherwise it means all 360°.	

Assembler:_____ Date:_____ Inspector:_____ Date:_____

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VI. PRODUCTION TEST SHEET MG-5600

Model	Serial Number	BOM Number	Order Number	Customer	Ratio	Input Speed Range*

Limits for Marine Transmission Equipped with Control Valve with 1725 kPa (250 psi) Spring (CIRCLE UNITS IN ACTUAL COLUMN)

rpm	Range	Valve Inlet			Primary		Secondary		Lube**			Cooling Temp. °C °F
		Min. kPa (psi)	Act. kPa psi	Max. kPa (psi)	Min. kPa (psi)	Act. kPa psi	Min. kPa (psi)	Act. kPa psi	Min. kPa (psi)	Act. kPa psi	Max. kPa (psi)	
□1100 □1500 □1900	Primary	1690 (245)		1830 (265)	1690 (245)		0 (0)		100 (15)		380 (55)	
	Secondary	1690 (245)		1830 (265)	0 (0)		1690 (245)		100 (15)		380 (55)	
	Neutral	280 (40)		590 (85)	0 (0)		0 (0)		280 (40)		450 (65)	
600	Primary	1660 (240)		1790 (260)	1660 (240)		0 (0)		7 (1)		69 (10)	
	Secondary	1660 (240)		1790 (260)	0 (0)		1660 (240)		7 (1)		69 (10)	
	Neutral	125 (18)		350 (51)	0 (0)		0 (0)		20 (3)		140 (20)	

* Input Speed Ranges (Test speed): 900-1299 rpm (1100 rpm); 1300-1699 rpm (1500 rpm); 1700-2100 rpm (1900 rpm), Do not exceed maximums.

** Cooling temperature range: Delvac 1110 Oil at 30º - 35ºC(86º - 95ºF) or Mobilkote 501 at 32º - 38ºC (90º - 100ºF)

Required: Primary lube pressure = secondary lube pressure within 21 kPa (3 psi)

ALL SHIFTS MUST BE DONE AT OR BELOW 900 RPM

A reading outside the limiting range could mean:

- ◦Valve Inlet Pressure: faulty valve springs, sticky valve, pump flow too low or high, wrong valve spring shims or quantity of shims, wrong pump installed, leakage – broken, forgotten or cut seal rings
- ◦Primary & Secondary Pressure: broken seal ring at collectors or piston
- ◦Lube Pressure: out-of-tolerance or missing orifices, broken rear seal ring, faulty lube relief valve

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VI. (CONTINUED) **PRODUCTION TEST SHEET**
MG-5600

Model	Serial Number	BOM Number	Order Number	Customer	Ratio	Input Speed Range*

Limits for Marine Transmission Equipped with Control Valve with 2000 kPa (290 psi) Spring (CIRCLE UNITS IN ACTUAL COLUMN)

rpm	Range	Valve Inlet			Primary		Secondary		Lube*			Cooling Temp. °C °F
		Min. kPa (psi)	Act. kPa psi	Max. kPa (psi)	Min. kPa (psi)	Act. kPa psi	Min. kPa (psi)	Act. kPa psi	Min. kPa (psi)	Act. kPa psi	Max. kPa (psi)	
□1100 □1500 □1900	Primary	1960 (285)		2137 (310)	1960 (285)		0 (0)		100 (15)		380 (55)	
	Secondary	1960 (285)		2137 (310)	0 (0)		1960 (285)		100 (15)		380 (55)	
	Neutral	280 (40)		689 (100)	0 (0)		0 (0)		280 (40)		450 (65)	
600	Primary	1724 (250)		1931 (280)	1724 (250)		0 (0)		7 (1)		69 (10)	
	Secondary	1724 (250)		1931 (280)	0 (0)		1724 (250)		7 (1)		69 (10)	
	Neutral	255 (37)		310 (45)	0 (0)		0 (0)		20 (3)		140 (20)	

* Input Speed Ranges (Test speed): 900-1299 rpm (1100 rpm); 1300-1699 rpm (1500 rpm); 1700-2100 rpm (1900 rpm); Do not exceed maximums.

** Cooling temperature range: Delvac 1110 Oil at 30° - 35°C(86° - 95°F) or Mobilkote 501 at 32° - 38°C (90° - 100°F)

Required: Primary lube pressure = secondary lube pressure within 21 kPa (3 psi)

ALL SHIFTS MUST BE DONE AT OR BELOW 900 RPM

A reading outside the limiting range could mean:

- ◦Valve Inlet Pressure: faulty valve springs, sticky valve, pump flow too low or high, wrong valve spring shims or quantity of shims, wrong pump installed, leakage – broken, forgotten or cut seal rings
- ◦Primary & Secondary Pressure: broken seal ring at collectors or piston
- ◦Lube Pressure: out-of-tolerance or missing orifices, broken rear seal ring, faulty lube relief valve

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Notes

The unit is to pass all these checks and tests before being approved for shipment.
Please follow your routing instructions carefully. The routing contains additional information to assist you in determining when it is best to apply each check and test and it also offers additional guiding instructions.

I. ASSEMBLY INSTRUCTIONS

Assembly check limits are given in section V.

1. Unless otherwise specified:
   - A. Degrease surfaces of taper bores and their mating shaft seats per S765 "Assembly Instructions" before assembly.
   - B. All bolts, screws and nuts are to be "as received" from bins with only light rust preventative oil on them and torqued per S574.
   - C. The main housing should be oriented with input end up during installation of input reduction gear box and down during installation of transmission shaft assemblies.

2. Transfer Driving and Driven Gears Taper Joint Assembly:

   Joint surfaces to be in condition described in I.1.A. Place gears on shafts using 445-890 N (100 - 200 lbf) max. force to seat them on their tapers. Advance each gear. A static pressure of approximately 569 - 738 kN (64 - 83 tons) will be required.

   For primary and secondary shaft assemblies, advance gear within 0.00 - 0.05 mm (.000 - .002 in) of the shaft shoulder at the small diameter end of the taper, and record advance.

3. Output Gear Taper Assembly:

   Joint surfaces to be in condition described in I.1.A. Coat the tapered surfaces with thin oil. Install cylindrical roller bearing outer race/roller assembly, along with snap ring, into main housing. Use suitable "C" type lift fixture to position gear into correct position. Install cylindrical roller bearing inner race and snap ring onto output shaft. Install the output shaft assembly thru the gear bore and into the cylindrical roller bearing outer race/roller assembly. Connect oil injection equipment assembly tool.

   Use portable press (890 kN [100 ton] capacity) and fixture to seat gear using 1340 N (300 lbf) load. Inject oil with a viscosity of 300 mm^2/s (300 cSt) at the operating temperature into the shaft until it leaks out of both ends of the mating surfaces.

   Advance gear to shaft shoulder stop. Release injection oil pressure between the mating

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surfaces and wait 5 minutes before lowering the pull on force and removing the assembly tool. Record actual advance.

4. Output Flange Taper Assembly:

Joint surfaces to be in condition described in I.1.A. Coat the tapered surfaces with thin oil. Measure distance from output shaft end to taper roller bearing cone assembly face. Measure length of output flange hub taper. Note: With the output flange fully assembled the difference between these two measurements must equal the space available for shaft end shims within 0.05mm (.002 in).

Install output flange onto output shaft along with retainer washer and screws. Connect oil injection equipment to output flange hub. Seat hub using 1340 N (300 lbf) load. Inject oil with a viscosity of 300 mm^2/s (300 cSt) at the operating temperature into the hub until it leaks out between the hub and shaft.

Continue injecting oil, while using retainer washer screws to advance flange to bearing stop. Release injection oil pressure between the mating surfaces and wait 5 minutes before removing screws and retainer washer. Record actual advance.

5. Splines:

The reduction gear box input hub to input shaft spline may be pressed together cold or with internal spline heated to 149°C (300° F).

The reduction gear box output spline to transmission input spline is a loose fit and shaft must assemble without need to heat the internal spline.

6. Taper Roller Bearing Adjustment:

A. Reduction gear box input and output shaft bearings:
Push-Pull bearing adjustment method:
Shim tapered roller bearings per S692-IV A1 to the specified dial indicator endplay with all cover bolts fully torqued. Record endplay.

B. Transmission primary and secondary shaft bearings:
Shim bearings with spacers and shim assemblies.

Push-Pull bearing adjustment method:
Shim tapered roller bearings per S692-IV A1 to the specified dial indicator endplay with all cover bolts fully torqued. Shims are to be assembled with the thickest shim against the bearing cup. Record endplay.

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C. Transmission output shaft bearings:
Push-Pull bearing adjustment method:
Shim thrust bearings per S692-IV A1 using thrust force shown below.
Record endplay.

	S692 III. THRUST
OUTPUT SHAFT	1340 - 4000 N (300-900 lbf)

7. Retainer Washer Shimming Procedure:

At output shaft: Determine the gap (flange face protruding beyond end of shaft). Measure gap and use shims 0.08 - 0.15 mm (.003 - .006 in) thinner than gap. No record is required.

8. Input Hub-Coupling Joint Assembly and Input Shaft Centering Plate Screws:

Apply MA908 to the as received bolts just before assembly, and torque per S574.

II. ASSEMBLY CHECKS
(General)

1. Visually inspect housing and components for imperfections.

2. Backlash: Roll all gears to insure no binding. The expected backlash including housing tolerances is given below.

Reduction Gear Box Gears: 0.15 - 0.28mm (.006 - .011 in)
Transfer Driving to Transfer Driven Gear: 0.15 - 0.28mm (.006 - .011 in)
Transmission Reduction Gears: 0.15 - 0.28mm (.006 - .011 in)

3. Record total indicator runout of the following items specified in section V.

4. Recheck dipstick.

III. NAMEPLATE DATA

1. Oil Capacity: 110 L (29 gal)

2. Minimum oil pressure ⊗ when cruising.
MG-5600DR - (Assembly 1018100; 1800 kPa (260 psi)

3. See shop order for bill of material and model numbers. Also apply serial number, ratio and customer number, when applicable.

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IV. PRODUCTION TESTING

1. Mount all gauges and add oil (closed sump) using Delvac 1110 oil at 30° - 35°C (86° - 95° F). Mobilkote 501 oil at 32° - 38°C (90° - 100°F) or any comparable rust preventative oil having 20 - 26mm²/s (200 - 260 SSU) at test temperature.

   A. ⊗ Valve Inlet gauge connected into pressure point at the top of the valve body.

   B. Ⓖ Lube Pressure gauge connected into manifold at plug (AM1038E).

   C. Ⓩpc Primary Clutch Actuated Pressure gauge connected into manifold at plug (MA1038D) at the primary shaft.

   D. Ⓩsc Secondary Clutch actuated Pressure gauge connected into manifold at plug (MA1038D) at secondary shaft.

2. Run at 780 rpm. Make a few shifts to primary, secondary and neutral. If unit performs and sounds satisfactory, accelerate to *rpm (shown in IV.3.) until oil temperature is at a minimum temperature in IV.1. All shifting must be done at or below 900 rpm.

3. Limits for Marine Transmission Equipped with Control Valve:

   After unit is up to required temperature at *rpm (shown below), check and record pressure as charted in section VI. Then reduce speed to 780 rpm and check and record pressures as charted in section VI.

   The unit should not be run at speeds in excess of the specified speed. The *rpm for test is dependent on overall ratio shown in the "Remarks" column of the bill of material.

   Use *rpm test speeds as shown below.

Bill of Material Overall Ratio	Input test Speed *rpm Required
7.01:1	2100
6.56:1	1950
6.02:1	1800

   A reading outside the limiting range as charted in section VI. could mean:

   Valve Inlet Pressure:

   Faulty valve springs, sticky valve, pump flow too low or high, wrong valve spring shims or quantity of shims, wrong pump installed,

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leakage--broken, forgotten or cut seal ring.

Primary & Secondary Pressures:
Broken seal ring at collectors or piston.

Lube Pressure:
Out of tolerance or missing orifices, broken rear seal ring, faulty lube relief valve.

4. Drag Check. The unit is acceptable if after shifting the transmission control valve to neutral, the output shaft remains at rest or can be held at rest with force charted in section VI. when using 780 rpm input speed. Record if okay.

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V. ASSEMBLY CHECK SHEET MG-5600DR (1018100)

Model	BOM Number	Serial Number	Ratio	Assembly Date

Transmission Primary Transfer Gear Advance		
Minimum 3.33 mm (.131 in)	Actual	Maximum 4.29 mm (.169 in)

Transmission Secondary Transfer Gear Advance		
Minimum 3.33 mm (.131 in)	Actual	Maximum 4.29 mm (.169 in)

Transmission Output Gear Advance		
Minimum 11.86 mm (.467 in)	Actual	Maximum 13.54mm (.533 in)

Transmission Output Flange Advance		
Minimum 10.16mm (.400 in)	Actual	Maximum 12.35mm (.486 in)

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V. (continued)

ASSEMBLY CHECK SHEET
MG-5600DR (Assembly 1018100)

Reduction Gear Input Shaft Tapered Roller Bearing Endplay		
Minimum 0.05 mm (..002 in)	Actual	Maximum 0.15 mm (.006 in)

Reduction Gear Output Shaft Tapered Roller Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Transmission Primary Shaft Tapered Roller Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Transmission Secondary Shaft Tapered Roller Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Transmission Output Shaft Bearing Endplay		
Minimum 0.05 mm (.002 in)	Actual	Maximum 0.15 mm (.006 in)

Record total indicator runout of the following, max. allowable shown.	Actual
0.10mm (.004 in) face of propeller flange near O.D. from main housing.	
0.10mm (.004 in) pilot of propeller flange from main housing.	

Tester:_____ Date:_____ Inspector:_____ Date:_____

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VI.

PRODUCTION TEST SHEET
MG-5600DR (Assembly 1018100)

Model	Serial No.	BOM No.	Order No.	Customer	Ratio	Input Speed

Limits for Marine Transmission Equipped with Control Valve with 2000 kPa (290 psi) Spring (CIRCLE UNIT IN ACTUAL COLUMN)

Ratio or rpm	Range	Valve Inlet			Primary		Secondary		Lube*			Cooling Temp. °C °F
		Min. kPa (psi)	Act. kPa (psi)	Max. kPa (psi)	Min. kPa (psi)	Act. kPa (psi)	Min. kPa (psi)	Act. kPa (psi)	Min. kPa (psi)	Act. kPa (psi)	Max. kPa (psi)	
Ratio □7.01:1 2100 rpm □6.56:1 1950 rpm □6.02:1 1800 rpm	Primary	1960 (285)		2137 (310)	1960 (285)		0 (0)		100 (15)		380 (55)	
	Secondary	1960 (285)		2137 (310)	0 (0)		1960 (285)		100 (15)		380 (55)	
	Neutral	280 (40)		689 (100)	0 (0)		0 (0)		280 (40)		450 (65)	
RPM 780	Primary	1724 (250)		1931 (280)	1724 (250)		0 (0)		7 (1)		69 (10)	
	Secondary	1724 (250)		1931 (280)	0 (0)		1724 (250)		7 (1)		69 (10)	
	Neutral	255 (37)		310 (45)	0 (0)		0 (0)		20 (3)		140 (20)	

*Cooling temperature range: Delvac 1110 Oil at 30°C - 35°C(86° - 95°F) or Mobilkote 501 at 32°C - 38°C (90° - 100°F)
Required: Primary lube pressure = secondary lube pressure within 21 kPa (3 psi)
ALL SHIFTS MUST BE DONE AT OR BELOW 1200 RPM

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VI.

PRODUCTION TEST SHEET
MG-5600DR (Assembly 1018100)

Observable Drag Limits At 780 rpm Input Speed IN NEUTRAL			Ratio Check @ 1800 rpm		Final Checks	
Gear Ratio	**Max. Pull Tangent at 400 mm (15.75 in) Dia. Output Flange Hole Circle N (lbf)**	**Actual N (lbf)**	**Output rpm**	**Actual rpm**		
7.01:1	271 (60.9)		256.8			Name Plate & Serial No.
						Measurements in Accepted Range
6.56:1	271 (60.9)		274.4			Capscrews torqued Per S574
						Leakage - None Permitted
6.02:1	271 (60.9)		299.0			Lube Filter
						Mounting Holes

Motor Drag at 1800 rpm Input Speed	
Range	**Actual N-m (lbf-ft)**
Primary	
Secondary	
Neutral	

Tester:_____ Date:_____

Inspector:_____ Date:_____

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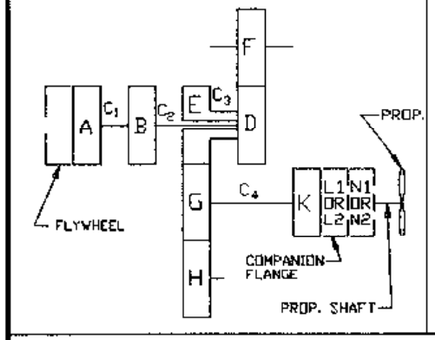
Notes

PRIMARY



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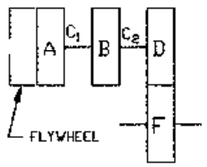
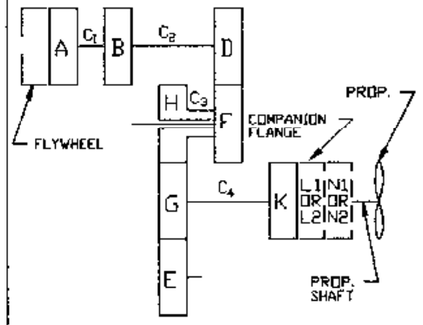


SECONDARY



WR^2 $(Kg \cdot m^2)$

	MASS	1015239 OR 1016001 RATIOS 2.53:1	2.98:1	3.51:1	4.03:1	5.04:1	6.04:1
A	FLEXIBLE COUPLING OUTER PARTS		ⓐ FOR ALL RATIOS				
B	FLEXIBLE COUPLING INNER PARTS, 1/4 PRIMARY SHAFT C_2 ADAPTER, HUB		ⓐ FOR ALL RATIOS				
D	DRIVING TRANSFER GEAR, REAR BEARING, 3/4 PRIMARY SHAFT C_2, PISTON, BACKPLATE, DRIVING PLATES		1.1 FOR ALL RATIOS				
E	PRIMARY PINION, CLUTCH HUB, NEEDLE BEARING, PINION BEARINGS, DRIVING PLATES	.89	.76	.57	.44	.37	.32
F	DRIVEN TRANSFER GEAR, REAR BEARING, SECONDARY SHAFT, PISTON, BACKPLATE, DRIVING PLATES		1.1 FOR ALL RATIOS				
G	OUTPUT GEAR, BEARING & OUTPUT SHAFT C_4	19	25	32	36	47	48 Ⓐ
H	SECONDARY PINION, CLUTCH HUB, NEEDLE BEARING, PINION BEARINGS, DRIVING PLATES	.89	.76	.57	.44	.37	.32
K	OUTPUT FLANGE, OUTPUT SHAFT C_4		2.69 FOR ALL RATIOS				
L1	COMPANION FLANGE, (ALL RATIOS WITHOUT BRAKE DISC OR 4.03:1 LESSER RATIOS WITH BRAKE DISC N1 ONLY)	5.3	5.3	5.3	5.3	5.3	5.3
L2	COMPANION FLANGE (5.04:1 AND 6.04:1 RATIOS ONLY WITH BRAKE DISC N2)					9.1	9.1
N1	762mm BRAKE DISC DIA. (USE WITH L1 ONLY)	3.0	3.0	3.0	3.0		
N2	914mm BRAKE DISC DIA. (USE WITH L2 ONLY)					6.9	6.9

$T/\phi = \frac{\pi r^4 G}{2L}$ = TORSIONAL RIGIDITY (N·m/rad)

FLEXIBLE COUPLING C_1	ⓐ
PRIMARY SHAFT C_2	1.07×10^6
PINION HUB C_3	35.7×10^6
OUTPUT SHAFT C_4	40.1×10^6

	MIN. O.D. OR ROOT DIA. (mm)	$J = \frac{\pi}{32}(D^4 - d^4)$ (m^4)
PRIMARY SHAFT C_2	82.0	44.4×10^{-7}
PINION HUB C_3	138.0	$283.X10^{-7}$
OUTPUT SHAFT C_4	185.	$1150.X10^{-7}$

ⓐ REFER TO 1015239 (CLOSE COUPLED), SHEET 3 OR 1016001 (REMOTE), SHEET 5 FOR WR^2 AND TORSIONAL RIGIDITY (STIFFNESS) DATA.

ALL WR^2 APPLY DIRECTLY TO NAMED MASS. TO RELATE ELSEWHERE, USE RATIO OF UNIT. RATIO OF D/F=1.00.
ALL MASSES HAVE RELATED MISCELLANEOUS HARDWARE INCLUDED IN WR^2. WR^2 OF OIL IS OMITTED.

THIRD ANGLE PROJECTION

REV	CH. NO.	DATE	REV	CH. NO.	DATE
B	27108	7-29-96			
A	25956	3-6-95			

SIMILAR TO

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MATERIAL

HEAT TREAT

SURFACE TREATMENT

WEIGHT LBS. | WR^2 LBS. IN^2

FIRST USE
ASSY. 1015239
MODEL MG5600

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

NAME
MASS ELASTIC SYSTEM

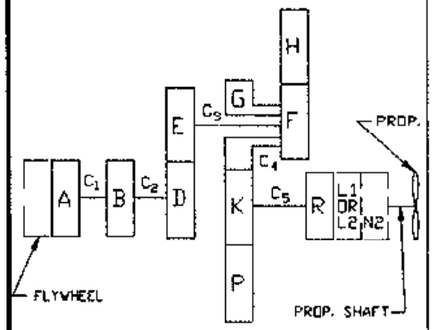
DATE 1-16-95
SCALE NONE=1°
DRN. KS
CHK. HWM
APPD. TBC

TWIN DISC INCORPORATED
RACINE, WI 53403 - USA

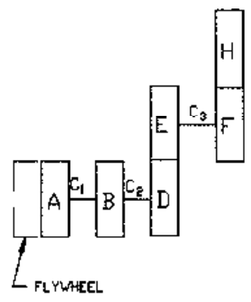
B3504AH

SHEET 1 OF 1 | REV B

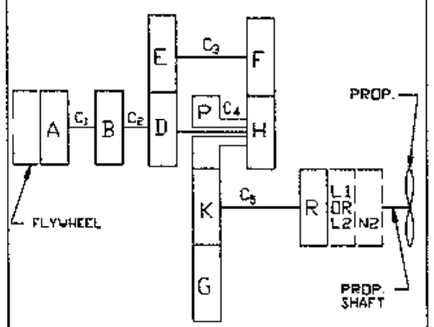
PRIMARY



NEUTRAL



SECONDARY



WR^2 $(Kg \cdot m^2)$

	MASS	1018100 RATIOS	7.01:1	6.56:1	6.02:1
		E/D	1.39:1	1.30:1	1.20:1
A	FLEXIBLE COUPLING OUTER PARTS		◎ FOR ALL RATIOS		
B	FLEXIBLE COUPLING INNER PARTS, 3/8 SHAFT & GEAR C_2, ADAPTER, HUB		◎ FOR ALL RATIOS		
D	5/8 SHAFT & GEAR, BEARINGS		.39	.45	.55
E	GEAR, BEARINGS, 1/4 PRIMARY SHAFT C_3		1.7	1.5	1.2
F	DRIVING TRANSFER GEAR, REAR BEARING, 3/4 PRIMARY SHAFT C_3, PISTON, BACKPLATE, DRIVING PLATES		1.1 FOR ALL RATIOS		
G	PRIMARY PINION, CLUTCH HUB, NEEDLE BEARING, PINION BEARINGS, DRIVING PLATES		.37 FOR ALL RATIOS		
H	DRIVEN TRANSFER GEAR, REAR BEARING, SECONDARY SHAFT, PISTON, BACKPLATE, DRIVING PLATES		1.1 FOR ALL RATIOS		
K	OUTPUT GEAR, BEARING & OUTPUT SHAFT C_4		47 FOR ALL RATIOS		
P	SECONDARY PINION, CLUTCH HUB, NEEDLE BEARING, PINION BEARINGS, DRIVING PLATES		.37 FOR ALL RATIOS		
R	OUTPUT FLANGE, OUTPUT SHAFT C_5		2.69 FOR ALL RATIOS		
L1	COMPANION FLANGE, (WITHOUT BRAKE DISC)		5.3 FOR ALL RATIOS		
L2	COMPANION FLANGE (WITH BRAKE DISC N2)		9.1 FOR ALL RATIOS		
N2	914mm BRAKE DISC DIA. (USE WITH L2 ONLY)		6.9 FOR ALL RATIOS		

$T/\phi = \frac{\pi r^4 G}{2L}$ = TORSIONAL RIGIDITY (N·m/rad)

FLEXIBLE COUPLING C_1	◎
SHAFT & GEAR C_2	4.19×10^6
PRIMARY SHAFT C_3	1.07×10^6
PINION HUB C_4	35.7×10^6
OUTPUT SHAFT C_5	40.1×10^6

	MIN. O.D. OR ROOT DIA. (mm)	$J = \frac{\pi (D^4 - d^4)}{32}$ (m^4)
SHAFT C_2 & C_3	82.0	44.4×10^{-7}
PINION HUB C_4	138.0	$283.X10^{-7}$
OUTPUT SHAFT C_5	185.	$1150.X10^{-7}$

◎ REFER 1018100 FOR WR^2 AND TORSIONAL RIGIDITY (STIFFNESS) DATA.

ALL WR^2 APPLY DIRECTLY TO NAMED MASS. TO RELATE ELSEWHERE, USE THE FOLLOWING: REFER TO CHART FOR RATIO OF E/D, RATIO OF F/C=1.00, RATIO OF K/G AND K/P = 5.04:1. ALL MASSES HAVE RELATED MISCELLANEOUS HARDWARE INCLUDED IN WR^2. WR^2 OF OIL IS OMITTED.

THIRD ANGLE PROJECTION

REV	CH. NO.	DATE	REV	CH. NO.	DATE

SIMILAR TO

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MATERIAL

HEAT TREAT

SURFACE TREATMENT

WEIGHT LBS.	WR^2 LBS. IN^2

FIRST USE
ASSY. 1018100
MODEL MG5600DR

NAME
MASS ELASTIC SYSTEM

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

DATE 3-23-98
SCALE NONE=1"
DRN. SWP
CHK. DAS
APPD. DAS

TWIN DISC INCORPORATED
RACINE, WI 53403 - USA

B3504AT

SHEET 1 OF 1 REV ---

#1020007 05/01

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